EQUITY IN TRANSPORTATION SAFETY AND PRELIMINARY ASSESSMENT IN HAWAII

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By

Rafaela de Melo Barros

Thesis Committee:
Dr. Panos D. Prevedouros (Chairman)
Dr. Eftihia Nathanail (Member)
Dr. Guohui Zhang (Member)
Dr. Suwan Shen (Member)

We certify that we have read this thesis and that in our opinion it is satisfactory in scope and quality as a thesis for the degree of Master of Science in Civil and Environmental Engineering.

THESIS COMMITTEE

_____

Chairman

_____

Member

_____

Member

_____

Member

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EXECUTIVE SUMMARY

The Center for Safety Equity in Transportation (CSET) is a collaboration between the universities of Hawaii, Alaska, Idaho and Washington, and their research focus is on transportation safety equity for rural, isolated, tribal and indigenous communities (RITI communities). CSET's goal is to offer a safe and efficient transportation system to RITI communities while preserving the culture and making sure that those with restricted travel alternatives are accounted for.

The RITI community in Hawaii is the native Hawaiians and part Hawaiians and Pacific Islanders; many of them live in rural areas. Hawaii does not have Indian reservations, but there are a few rural locations where there is a higher percentage of CSET minorities (e.g., Waianae, Waimanalo). There are a significant number of fatal crashes involving minorities in Hawaii and considering all CSET states, Hawaii presented the highest amount of those fatalities.

The objective of the research in this thesis is to obtain an understanding of the perceptions of minority groups and all others on urban and rural transportation equity, while correlating with demographic characteristics such as gender, age and education.

The study began with a literature review of topics such as equity, minorities, transportation equity, traffic safety equity and emergency medical services response time. With the findings from this review, a survey was created in order to reach out to the minority groups in Hawaii to try to understand what they think about transportation equity and rural safety transportation in the state. The survey analysis was made by comparing the results with socio-demographic characteristics of the respondents. Five transportation equity-related questions were chosen from the big survey and an additional eight questions on rural safety were selected for in-depth analysis.

The outcome of the data analysis for the equity-related questions shows that people's perception in EMS response between rural and urban areas is that it is about the same. The respondents disagreed with (1) paying more taxes in order to improve EMS response in rural areas (2) having the government convert rural roads into high standard roads to make them safer, and (3) paying more taxes so the government can raise the standard on rural roads.

The results for the rural safety perception analysis was that the participants consider that the following are not a problem at all in rural Hawaii: (1) cell phone reception for emergency calls, (2) access to public transportation, and (3) absence of signalized intersections. Ambulance response to emergencies in rural roadways, and hidden, missing or defaced traffic signs the respondents were perceived as moderately problematic. Faded or worn out lane markings, and lighting at night, were perceived as problematic.

Keywords: Equity, Transportation equity, Traffic safety equity, CSET, minorities, Rural roads safety.

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1 Introduction

1.1 Background

The University of Hawaii in collaboration with the universities of Alaska, Idaho and Washington received funding for a Tier-1 University Transportation Center from the U.S. Department of Transportation, called the Center for Safety Equity in Transportation (CSET). The focus of the center's research is on transportation safety equity for rural, isolated, tribal and indigenous communities (RITI communities). Safety approaches will be developed that are sensitive to heritage, traditional ways of knowing and learning, and the preservation of culture to provide everyone with fair and equitable access to a safe transportation system.

About 95% of the United States area has a population lower than 200 people per square mile. Rural America encompasses up to 80% of the country's transportation network; about half of the road fatalities occur in rural areas. CSET's goal is to offer a safe and efficient transportation system to RITI communities while preserving the culture and making sure that those with restricted travel alternatives are accounted for.

CSET has just about finished the second year of the five year project, and have collected various aggregate (i.e., Census type) of data in developing an understanding of RITI communities which in Hawaii include (i) Native Hawaiians, Part Hawaiians and Pacific Islanders, and (ii) selected rural communities such as Waianae, Waimanalo and most of the Big Island.

There are a significant number of fatal crashes involving minorities in Hawaii. The native Hawaiians and part Hawaiians are the ones considered minority in the state and they live mostly in rural areas. In general, there is not much research or data on rural regions. The main idea of this study is to figure out a way to understand the perceptions of minority groups on transportation and traffic safety and at the same time not to cross any line that they could think is disrespectful with their culture.

Urban and rural areas are different by definition and that is where the transportation equity fits in this research. Urban regions have more people, more vehicles, more roads, and consequently more chances of an accident to occur. With

that, more money is invested on traffic safety. On the other hand, rural regions have fewer people, vehicles and roads. There is a serious traffic-related issue: Rural areas present a higher percentage of fatal crashes when comparing the proportions of population and fatal accidents. The reason why it occurs needs to be addressed.

Prevedouros et al. [4], analyzed the crash data provided from FARS between all four CSET states: Alaska, Hawaii, Idaho and Washington from 2007 to 2016. The Fatality Analysis Reporting System (FARS) is a national statistic about fatal injuries occurred due to motor vehicle accidents [3]. For the report, the authors considered the RITI areas in Hawaii the ones that have the highest percentage of native Hawaiians and part Hawaiians, since the state does not have an Indian reservation. Those locations were the Waianae and Waimanalo communities on Oahu, plus the entire island of Big Island.

From 10-year data study, Hawaii had 347 fatalities of minorities, representing 31% of the total on the state. Considering all CSET states, Hawaii presented the highest amount of minority fatalities. The percentage of Hawaii's CSET minorities involved in fatal crashes younger than 35 years old was almost 60% and that is considerably higher compared to the nonminority's' population.

The three top reasons for fatal crashes are speeding, non-usage of restraint and impaired driving. In Hawaii, 48% of the fatalities associated with speeding were CSET minorities.

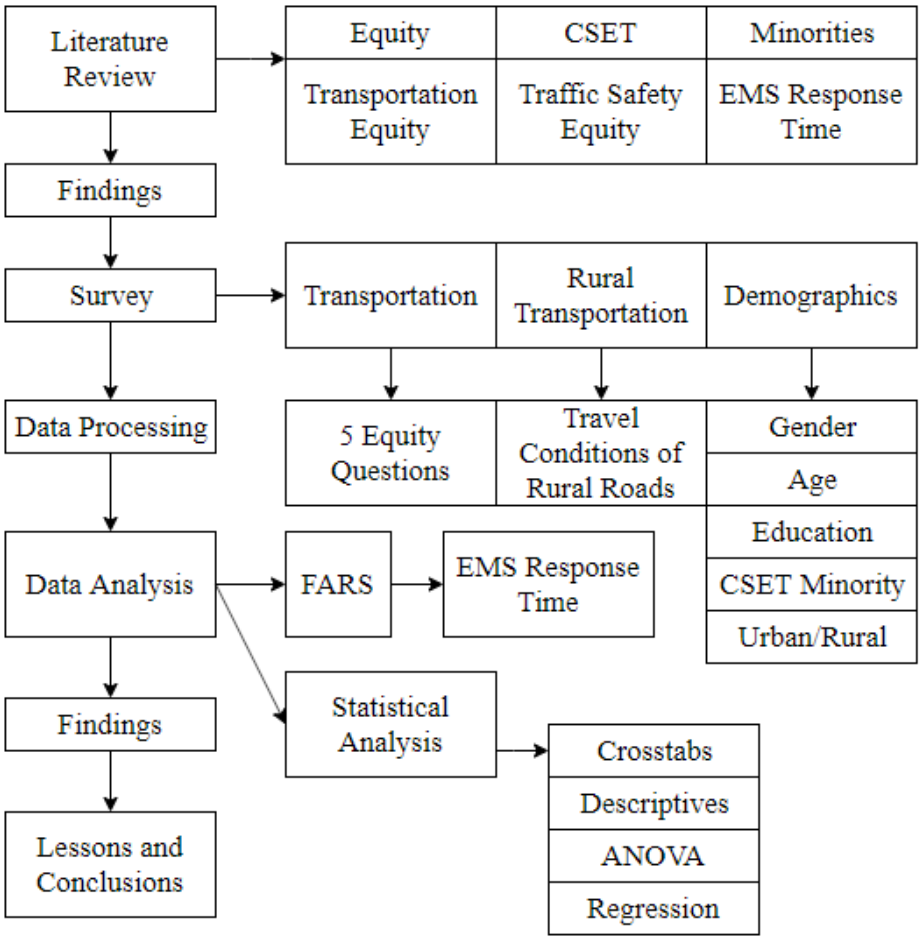
1.2 Thesis Outline

This thesis is composed of five chapters and two Appendixes. The first chapter is the introduction of the study presenting the background with the reasons why the research started. The second chapter contains the objectives and methodology. The third chapter is the literature review detailing equity, transportation equity, traffic safety equity, rural roads and EMS response time. The fourth chapter has the analysis and the results of the transportation survey. And finally, the fifth chapter is composed of the conclusions and future research. Appendix A has the transportation survey and Appendix B has all data analysis tables for the rural equity questions of the survey.

2 Objectives and Methodology

The objective of the research in this thesis is to get an initial understanding about the perceptions of minority groups and all others on urban and rural transportation equity, while correlating with demographic characteristics such as gender, age and education. The overall methodology is depicted in Figure 2.1. The methodology diagram presents a summary of the research process. It started with literature review in topics such as rural transportation, equity, CSET, minorities in Hawaii and EMS response time. With the findings of the literature review, a survey was created in three main topics: transportation, rural transportation, and demographics. After the survey was launched, the data has been processed and a statistical analysis was made leading to lessons and conclusion.

Figure 2.1 - Methodology diagram



In order to obtain an understanding of RITI communities in Hawaii, a survey was created to reach out to the minority groups in Hawaii to try to comprehend what they think about the matter. A survey is the best approach to learn about people's opinions and behaviors. It presents hard numbers making it possible to assemble important opinion, comments, feedbacks, and to make comparisons. Also, respondents are more inclined to contribute with honest feedback in a confidential survey method.

The goal was to reach the greater amount of RITI communities and understand their perception about the traffic conditions in Hawaii specifically about equity in rural areas. The survey was divided in three parts: transportation, rural transportation and demographics. The complete survey is presented at Appendix A. The first part asked the respondents to answer question such as how long they commute per day, their behavior while driving, their opinion about the current traffic in Hawaii, and about traffic accidents. The second part focused on rural roads and asked to rank travel conditions, vehicles behaviors, and connectivity. Also, this part had an empty box for additional comments about risky behaviors or risky conditions on rural roads. The third and last part, the demographics, requested information such as gender, age, education, employment status, ZIP code of residence, and race.

The analysis is made by comparing the results of the transportation survey with respondent's socio-demographic characteristics such as gender, age, race, education and residence location. Five transportation equity questions were developed as presented next. FARS data regarding EMS response time was used in this study as a basis for the comparison of rural and urban areas on Oahu and on the Big Island of Hawaii. Response time was defined as the amount of time from the notification of the accident to the EMS until the arrival of the EMS vehicle at the scene.

Please give us your opinion on the five urban-rural road questions below:

a) Think about emergency response for traffic accidents such as police, ambulance and fire truck. Compared to urban areas, in rural areas emergency response is:

[ ] 1. Far worse *[ ] 3. About the same* *[ ] 5. Much better*

[ ] 2. Worse *[ ] 4. Better*

b) Do you agree that the government should increase gasoline taxes in order to improve emergency response for rural roads?

[ ] 1. Strongly disagree *[ ] 3. Neutral* *[ ] 5. Strongly agree*

[ ] 2. Disagree *[ ] 4. Agree*

c) There are more fatal crashes on rural roads than on urban roads. High standard roads like freeways are the safest. Building high standard rural roads with two lanes per direction, a median, barriers and shoulders is much safer but costs a lot more.

Do you agree that the government should make rural roads safer by converting them to high standard roads given that the costs will be much higher?

[ ] 1. Strongly disagree *[ ] 3. Neutral* *[ ] 5. Strongly agree*

[ ] 2. Disagree *[ ] 4. Agree*

d) Do you agree that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads?

[ ] 1. Strongly disagree *[ ] 3. Neutral* *[ ] 5. Strongly agree*

[ ] 2. Disagree *[ ] 4. Agree*

e) Should more money, less money or about the same amount of money be provided to support urban road and highway improvements?

[ ] More money *[ ] About the same*

[ ] Less money *[ ] No opinion*

In addition, respondent's perceptions on the condition of rural roads in Hawaii were chosen for the statistical analysis on this thesis. Some characteristics of rural roads could increase the number of crashes such as higher speed limits, the absence of two lanes per direction, medians, barriers, and/or shoulders, the location of EMS stations, etc. Another consideration could be the level of education of rural area

residents as it relates to driving behaviors and safety. A total of 17 questions were asked regarding conditions on rural roads. Of those, 8 questions were deemed relevant to urban/rural equity and were included in the analysis herein. The 8 questions were as follows and were rated on a (0 to 5 scale where 0 is “Not a problem at all”, 3 is “Moderate problem” and 5 is “Big problem”).

Please rate these travel conditions on rural roads:

	1. Not a problem at all	*2.*	*3. Moderate problem*	*4.*	*5. Big problem*
Ambulance response to emergencies	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*
Cell phone reception for emergency calls	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*
Access to public transportation	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*
Road condition of state highways	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*
Hidden, missing or defaced traffic signs	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*
Faded or worn out lane markings	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*
No traffic lights at rural intersections	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*
Lighting at night	*[ ]*	*[ ]*	*[ ]*	*[ ]*	*[ ]*

The demographic characteristics chosen for the analysis in this study were five: gender, age, education, location of residence and race as explained on Table 2.1.

The races were grouped into two bigger groups: CSET and All Others. The CSET group is the one that includes the RITI communities and according to FARS, those communities are composed by American Indians (including Aleuts and Eskimos), Native Hawaiian (including part-Hawaiian), and Guamanians. For this analysis, CSET are composed by the Native Hawaiians and part Hawaiians, Guamanian or Chamorro, Samoan, Other Pacific Islander, and American Indian or Alaska native. All respondents that are not considered any of those races were referred to as “All Others”.

Table 2.1 - Demographics chosen for analysis

Demographics	Original Survey		Grouped for analysis
Gender	Male		Male
	Female		Female
Age	Under 15	46-55	Under 25
	15-25	56-65	26 to 55
	26-35	66-75	56 or older
	36-45	76 or older	
Education	Less than high school degree	Associate degree	High School or less than high school (HS or less)
	High school degree or equivalent	Bachelor's degree	Associate degree or some college but no degree (AD or some)
	Some college but no degree	Graduate degree	Bachelor or Graduate (BS or grad)
Location of residence	What's the zip code at your place of residence?		Rural
			Urban
			Suburban
Race	Native Hawaiian or part Hawaiian	Chinese	CSET
	Guamanian or Chamorro	Filipino	All others
	Samoan	Japanese	
	Other Pacific Islander	Korean	
	White	Hispanic/Latino	
	African American or Black	Vietnamese	
	American Indian or Alaska Native	Other Asian	
	Asian Indian	Other	

An important variable in this analysis is the difference between urban and rural areas. The U.S. Census Bureau classifies urban areas according to two definitions. The first type is Urbanized Areas with a population of 50,000 or more, and the second type is Urban Clusters with population between 2,500 and 50,000 people. Rural areas are characterized as all people, housing, and region that are not a part of an urban area. [1]

The Hawaii Strategic Development Corporation (HSDC) released a report in 2010 defining urban and rural areas in the state of Hawaii and used the U.S. Census Bureau as the basis. The HSDC claims that 63.6% of the total land area in Honolulu County is rural and 0.9% of the population lives in those rural lands; and 97.8% of the total land area in Hawaii County is rural and 38% of the population lives in those rural lands. [2]

For this research, we used the maps provided by the Hawaii Department of Transportation that pictured the limitations of the urban areas for each island. After careful analysis of the maps, the ZIP codes separated into rural, suburban and urban groups for each island are presented on Table 2.2.

Table 2.2 - Hawaii ZIP codes

	Rural			Urban			Suburban		
Oahu	96712	96762		96813	96818	96850	96701	96782	96857
	96717	96786		96814	96819	96853	96706	96795	96863
	96730	96789		96815	96822	96859	96707	96797	
	96731	96791		96816	96826	96860	96734	96821	
	96759	96792		96817	96848		96744	96825	
Big Island	96704	96749	96776	96720					
	96710	96750	96777	96725					
	96719	96755	96778	96740					
	96726	96760	96780						
	96727	96764	96781						
	96728	96771	96783						
	96737	96772	96785						
	96738	96773							
	96743	96774							
Kauai	96703	96716	96754				96741	96766	
	96705	96722	96756				96746		
	96714	96747	96769				96751		
	96715	96752	96796				96765		
Maui	96708	96757	96784	96732			96753		
	96713	96763	96788				96761		
	96729	96767	96790						
	96733	96768	96793						
	96742	96770							
	96748	96779							

Zoho is an online platform utilized for the creation of surveys, the easy reach of the public by any device, and the visualization of the results graphically and in real-time [15]. The survey was developed on this platform in order to easily reach the target community by email. No name or any identification information was collected on this

survey. Every page of the survey had the message “Your privacy is protected; all your answers are anonymous, and all results will be in summary form”.

Several surveys to special focus groups were deployed prior to the deployment of the main survey to 15,000 email accounts. This thesis summarizes the efforts and results of the testing stage that included eight test groups and received a total of 813 responses. All questions were optional so not everyone answered every question. Table 2.3 shows the total number of people that replied each of the eight surveys.

Table 2.3 - Frequency of each survey

Code	Survey Title	#	Percent
1	Charley’s Taxi - The Center for Safety Equity in Transportation Survey for Hawaii	239	29.4%
2	UH Students - The Center for Safety Equity in Transportation Survey for Hawaii	13	1.6%
3	CSET Survey of Native Hawaiians & Part Hawaiians & Pacific Islanders	18	2.2%
4	CSET Survey of Native Hawaiians & Part Hawaiians & Pacific Islanders	49	6.0%
5	University of Hawaii Center for Equity in Transportation Safety Survey for Oahu Transit Services	58	7.1%
6	CSET Survey of Traffic Issues in Hawaii	161	19.8%
7	CSET Survey of Traffic Issues in Hawaii	212	26.1%
8	CSET Survey of Traffic Issues in Hawaii	63	7.7%
	TOTAL	813	100.0%

In terms of analysis, once the responses were collected, the first step was to inspect for gross errors and merge the responses into one database file. This task involved some careful coordination of the spreadsheets because at various deployments, the order of questions was changed, some questions were dropped, and others were inserted.

With a final, clean database, the next step was to make cross tabulations and to calculate the percentage to get the results of each question related to each demographic characteristic. The third step employed regression models to assess specific correlations.

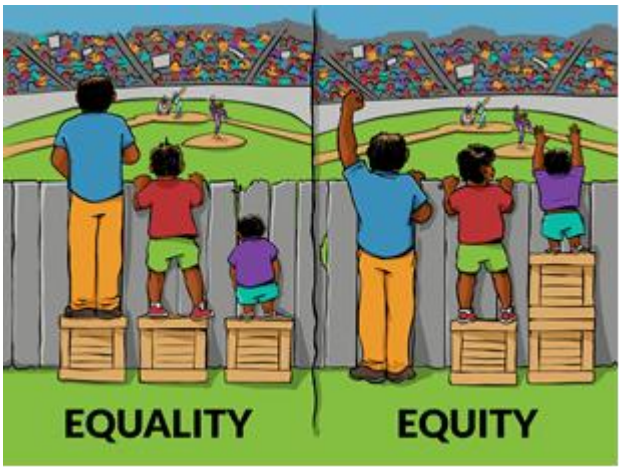
3 Literature Review

This review includes a summary of studies on the definition of equity, transportation equity and transportation network planning equity. It introduces other equity types such as procedural equity, geographic equity and social equity. The difference between traffic safety and traffic safety equity is discussed. Crashes on rural roads and EMS response time on rural roads are also discussed.

3.1 Equity

The simple cartoon in Figure 3.1 depicts the often-confused difference between equity and equality. Two sample definitions on equity are given below, the second of which applies to transportation.

Figure 3.1 - Equality vs. Equity



Interaction Institute for Social Change | Artist: Angus Maguire. Interactioninstitute.org and madewithangus.com.

As Shaheen et al. [5] stated: “There is not a universally agreed upon definition of equity and all of its facets; legislative and regulatory definitions narrowly focus on protected classes (inclusive of race, national origin, Americans with Disabilities Act (ADA) etc.) but often exclude unbanked, low-income, and digitally impoverished households. Additionally, there is no consensus about the acceptability of universal design–accessibility (everyone can access all modes) versus universal mobility

(everyone has access to a mode of transportation that can provide equivalent level of service)."

Bills et al. [6] said "Transportation equity generally refers to the fair or just distribution of transportation costs and benefits among current (and future) member of society".

Traditional areas at transportation equity analysis are planning, social justice, and policies such as user fees based on mileage, congestion charge zones, and parking pricing based on performance. Whenever there is a proposal on fare change, urban areas with a population larger than 200,000 are enforced to provide a fare equity analysis. This analysis made by Karner and Golub [16] means if the proposed change would have any negative effect on racial minorities and low-income people.

Socio-demographic characteristics like gender, age, race and income are typically considered in order to define social equity in transportation, according to Lee at al. [18]. However, to determine spatial equity, initially geographic groups are stratified and then each group is analyzed by its demographic characteristics. The goal of the spatial equity is to find out the locations where inequities take place. People with low-income rely more on different transportation modes because often they have access to obsolete vehicles. In the transportation modal context, there is an equity gap between safety and access as there are more fatalities with pedestrians and bikers than with drivers.

The transportation network planning equity has the goal to implement equal and fair economic and social opportunities for every demographic group and territory. As an example, presented by Sanchez et al. [12], every user should have access to emergency services, medical care, education, employment, food and clothing, recreational activities and commercial activities.

In 2012, the Federal Highway Administration (FHWA) recognized a few plans of action to focus on environmental justice. Those strategies include decrease human health impacts on minorities and low-income people, to include every single person in the process of transportation planning and providing equity to minorities and low-income people [17]. Metropolitan Planning Organizations (MPOs) have a continuous challenge

on attaining transportation equity simultaneously with following the regulations for civil rights and environmental justice. It can be reached by achieving an impartial dissemination of federal transportation funds among space and demographic groups.

According to Karner [10], there are three types of equity in the MPO assessments. The first one is *procedural equity*, meaning the procedures of public meetings such as the place where it will occur, the time and the formality of how the information will be delivered. The second is *geographic equity*, referring to the dissemination of funds across the territory such as rural, urban, and suburban areas. The third is *social equity* and it indicates the distribution of funds and benefits among demographic groups such as minorities vs. all others. In order to comprehend geographic and social equity, qualitative and quantitative measures are defined. Prevalent indicators include for instance: accessibility, average travel times, commute time, transit mode share, amount invested, and air quality. [10][6]

Karner and Marcantonio [22] suggest a new transportation equity planning model where the main focus of MPOs is the demands of minorities and low-income people. However, according to Sanchez [23] “it is difficult to gauge the level of commitment of MPOs to transportation equity principles simply by describing the types of planning activities that they undertake. Moreover, the racial and ethnic composition of voting members is only an indirect measure of adequate public participation and representation, although it may serve as an indicator of the degree to which minorities have a stake in regional policy making.”

The difference between traffic safety and traffic safety equity is the inclusion of the population’s needs. Traffic safety is about increasing the safety of the transportation systems while traffic safety equity is making sure this “safety” is evenly distributed across users from different demographic groups and regions. In other words, traffic safety only concerns the safety of what is beneficial for all, whereas traffic safety equity refers to the fairness of traffic safety for all population groups.

As specified Najaf et al. [11], transportation equity refers to the fairness among people of distinct localities, age groups, demographic characteristics and users of diverse transportation modes. In compliance with this framework, traffic safety equity

can be connected to these five factors: “public awareness and knowledge about traffic safety and safe driving skills, equal allocation of financial resources to different types of road networks, equal law enforcements for different groups of users, equal safety standards for low- and high-priced vehicles, integrated traffic control rules, signs and devices in all regions.”

Najaf et al. [11] support the idea of considering traffic safety equity as the central factor for the development of traffic safety policies built on equity considerations. A substantial goal holds on giving fair economic and social opportunities for everyone. One example would be to provide all transportation users including the transportation underprivileged people with basic access. To reinforce a sustainable growth and according to transportation equity, each one should have equal access to “emergency services, medical care, education, employment, food and clothing, recreational activities and commercial activities”.

For transportation network planning to be successful, it would have to equally allocate traffic safety to the entire community. Safe vehicles and safe roads are less common in RITI areas, so it would require better planning to make the traffic safety as good as in urban areas. One example would be ensuring that every single traveler has access to a safe vehicle that meets a certain level of safety.

As reported by Kim Beury [19], Congresswoman Virginia Smith of Nebraska proposed the Rural Transportation Equity Act in 1989. This legislation had the objective of reaching the balance of transportation funding between rural and urban areas provided by the federal government. At that time, rural communities received less than 3% of the transportation funds and a considerable percentage of the rural population had no vehicles, no buses or taxis and they had no alternative but to stay at home.

Frequently, rural roads are not designed as high standard roads such as expressways. Rural roads often come with blind curves, narrow widths, no shoulders, no medians, gravel or dirt surfaces, steep hills or sharp curves. According to the analysis Russo et al. [20], road characteristics such as AADT (annual average daily traffic), lane width, curvature change rate, length, and vertical grade can have a significant effect on the severity of accidents. Those attributes could be a problem in

rural roads, Karner and Marcantonio [22] stated that redesigning them (e.g., increasing lane width, median width, and inside and outside shoulder width) could be a solution in helping decrease the number of crashes. They assessed the impact of the geometric design of roads, the environment and the traffic attributes on head-on accidents and listed the causes of head-on crashes: undivided roadways, speeding, horizontal curve, high heavy-vehicle traffic, undulating terrains, access points and shoulder width; and their potential countermeasures such as installing median barriers, installing advisory speed signs, and widening shoulder width.

3.2 EMS response time

If a motor vehicle accident occurs and the injured patient gets definitive care in a period of until 1 hour of his injury, his chances of surviving are increased, and this is considered the “golden hour”. [13]

Emergency medical services are decisive in an accident located in rural settings where medical centers are somewhat far away. The response time is considered crucial on survival rates and there are some essential factors such as location of EMS station, condition of the road and of the traffic and weather.

The location of an EMS station has an extreme importance on reducing response time for critical situations. Ambulances have a meaningful effect on the survival of patients on prehospital medical care. Most of EMS stations located in rural areas are within the densest region, but the most critical tragic accidents occur on highways placed on the least dense region. Thereby EMS stations should be smartly placed near regions with the highest rate of crashes and consequently optimizing the response time.

According to NFPA, for life-threatening incidents, the response time of 8 minutes is acknowledged. As claimed by Gonzalez et al. [7] in their research in an area located in Alabama, the response time for EMS was 10.67 minutes in rural areas and 6.50 minutes in urban areas. When fatalities happened, the amount of time from the scene of the accident to an emergency department was 12.5 minutes in rural areas and 7.43 minutes in urban areas. Compared to urban areas, fatal crashes were twice the rate number of those on rural areas.

However, there are very few data regarding EMS response in rural areas which makes the development of performance measures challenging and the cost-effective improvement of the service difficult.

4 Analysis and Results

We used the data collected from the fall 2018 and spring 2019 phases of the CSET transportation survey. These phases included test versions of the large questionnaire to target groups (groups 1 to 7) as well as a large random deployment in May 2019 (4,649 initial addresses of which 3,146 were valid addresses which produced 344 responses for a response rate of 11%).

The survey collects responses to 31 questions, many of which were used in this study to understand people's perceptions on transportation urban-rural equity and to examine possible relationships between the equity responses (and responses to selected rural transportation questions which relate to equity) and demographic characteristics such as gender, age, race, education and residence location at a rural, urban or suburban location in Hawaii.

Statistical tests were deployed to determine whether the data collected from the survey support or contradict the equity propositions as explained later in this chapter. The analysis was conducted by using three sequential statistical methodologies: Cross-tabulation (frequency), descriptive statistics (mean and standard deviation), ANOVA (F-test) and Regression. These are procedures Crosstabs, Descriptive Statistics, General Linear Model Multivariate, and Linear Regression in SPSS.

The data analysis in this thesis is presented in three parts. The first part in section 4.1 presents the analysis of the EMS response time in rural and urban areas. The second and third part present the basic analysis, descriptive statistics, ANOVA and regression models from each of the survey questions as follows: Section 4.2 presents analysis on the five equity questions and Section 4.3 presents the eight rural safety perceptions questions.

4.1 EMS response time and FARS Data

Analysis using the Fatality Analysis Reporting System data was conducted with years from 2006 to 2017, based on earlier work for the CSET project [4]. The goal was to calculate the average EMS response time for urban areas and for rural areas in the counties of Honolulu and Hawaii. Specific elements were chosen to make this analysis possible. Each element chosen with its definition is shown below, based on the FARS Manual [24].

- **STATE:** This element identifies the state in which this vehicle was registered.
- **COUNTY:** This data element records the location of the event regarding the County. The codes are from the General Services Administration's (GSA) publication of worldwide Geographic Location Codes (GLC).
- **HOUR:** This data element records the hour at which the crash occurred.
- **MINUTE:** This data element records the minutes after the hour at which the crash occurred.
- **NOT_HOUR:** This data element records the hour that emergency medical service was notified.
- **NOT_MIN:** This data element records the minutes after the hour that emergency medical service was notified.
- **ARR_HOUR:** This data element records the hour that emergency medical service arrived on the crash scene.
- **ARR_MIN:** This data element records the minutes after the hour that emergency medical service arrived on the crash scene.
- **FATALS:** This data element records the number of fatally injured persons in the crash.
- **RUR_URB:** This data element identifies the classification of the segment of the roadway on which the crash occurred based on FHWA-approved adjusted Census boundaries of small urban and urbanized areas.

The time of crash, time of notification and time of EMS arrival at scene of accident were used. The difference from the time of arrival at scene and time of notification was calculated and defined as response time. It does not account for the

amount of time to dispatch the first emergency vehicle nor the duration of the 911 call; these are likely to be similar, on the average, for urban and rural locations. The total number of fatal crashes for each area of each of the two island counties is presented in Table 4.1.

The files had some missing data, so the cases used were the ones that had information for every single element chosen. The variables were split into counties and urban/rural areas for the final result, as shown in Table 4.2 and Table 4.3.

Table 4.1 - FARS number of cases for Honolulu County and Hawaii County

Year	Rural Cases		Urban Cases		Total Cases	
	Honolulu	Hawaii	Honolulu	Hawaii	Honolulu	Hawaii
2007			49	3	49	3
2008	5	19	26	4	31	23
2009	6	13	36	11	42	24
2010	10	18	43	8	53	26
2011	7	16	35	3	42	19
2012	8	25	46	5	54	30
2013	7	12	38	4	45	16
2014	6	10	44	3	50	13
2015	1	7	47	8	48	15
2016	2	9	49	14	51	23

Table 4.2 - Honolulu County EMS response time in minutes

HONOLULU				
Year	Rural		Urban	
	Average time to notify	Response Time	Average time to notify	Response Time
2007			7	7
2008	7	8	5	7
2009	5	8	6	7
2010	4	11	4	7
2011	5	8	4	7
2012	5	14	5	9
2013	6	7	6	9
2014	5	11	5	7
2015			5	7
2016	4	14	6	8
AVERAGE	5	**10**	5	**8**

Table 4.3 - Hawaii County EMS response time in minutes

HAWAII				
Year	Rural		Urban	
	Average time to notify	Response Time	Average time to notify	Response Time
2007			35	7
2008	4	12	6	10
2009	8	10	5	7
2010	6	14	6	9
2011	6	13	1	4
2012	3	13	3	6
2013	7	14	3	6
2014	2	10	3	7
2015	4	10	2	6
2016	4	11	3	8
AVERAGE	5	**12**	7	**7**

The EMS response time for rural Oahu (Honolulu County) was 10 minutes while for urban it was 8 minutes (Table 4.2), a 50% increase for rural. Likewise, for the Hawaii county, the rural EMS response time was 12 minutes and the urban was 7 minutes (Table 4.3), a 71% increase for rural. These findings over a decade provide a strong indication that EMS response time for traffic accidents is substantially longer in rural areas compared with urban areas.

4.2 Equity Questions

4.2.1 Basic statistics of equity questions

The basic statistics of responses in this study was made by cross-tabulation in SPSS. It is an analytical tool that creates joint distribution tables of two or more variables. In this case, it provided the count of how many people from a demographic group selected each of the options of the survey questions. Another table was created to provide the percentage of the counts. All percentile results greater than 50% are colored grey to visually represent the majority tendency of the responses.

Basic analysis of equity question 1 (EMS Response) on "*Compared to urban areas, in rural areas emergency response is*" by gender, age, education, location of residence, and race, is shown in Table 4.4. Major outcomes include the following: The overall result for this question is that respondents think that rural EMS response is about the same compared to urban response on Oahu. Both female and male respondents agree that rural EMS response compared to urban is about the same. All age groups also think the rural EMS response is about the same compared to urban. Concerning education, 52%, 53% and 49% are the percentages of the three groups considering once again that rural and urban EMS responses are about the same. About 46% of rural residents and 49% of urban residents have a different opinion from the suburban residents. Both rural and urban residents agree rural EMS response is worse than urban while 59% of suburban residents believe it is about the same. Regarding the race, 46% of CSET think the statement is worse and 53% of All Others agrees it is about the same.

Table 4.4 - Frequency/Percentage for Equity question 1

EMS Response by Gender	Worse	About the same	Better
Male	116	146	22
Female	64	70	11
Total	180	216	33

EMS Response by Gender	Worse	About the same	Better
Male	41%	51%	8%
Female	44%	48%	8%

EMS Response by Age	Worse	About the same	Better
Under 25	22	43	6
26 to 55	76	81	9
56 or older	82	94	18
Total	180	218	33

EMS Response by Age	Worse	About the same	Better
Under 25	31%	61%	8%
26 to 55	46%	49%	5%
56 or older	42%	48%	9%

EMS Response by Education	Worse	About the same	Better
HS or less	18	26	6
AD or some	49	70	13
BS or grad	114	121	13
Total	181	217	32

EMS Response by Education	Worse	About the same	Better
HS or less	36%	52%	12%
AD or some	37%	53%	10%
BS or grad	46%	49%	5%

EMS Response by Location	Worse	About the same	Better
Rural	29	28	6
Urban	89	80	13
Suburban	59	107	14
Total	177	215	33

EMS Response by Location	Worse	About the same	Better
Rural	46%	44%	10%
Urban	49%	44%	7%
Suburban	33%	59%	8%

EMS Response by Race	Worse	About the same	Better
CSET	49	46	11
All Others	130	171	21
Total	179	217	32

EMS Response by Race	Worse	About the same	Better
CSET	46%	43%	10%
All Others	40%	53%	7%

Basic analysis of equity question 2 (Gas Tax EMS) on "*Do you agree that the government should increase gasoline taxes in order to improve emergency response for rural roads?*" by gender, age, education, location of residence, and race is shown in Table 4.5. Major outcomes include the following: Every demographic group disagreed with the statement that the government should increase gasoline taxes in order to collect money to invest in improving EMS response in rural areas on Oahu. This result indicates that regardless of the respondent's characteristics, they all disagreed with the idea of increasing gasoline taxes even if they think that rural EMS response is worse in rural areas compared to urban areas (Table 4.4).

Table 4.5 - Frequency/Percentage for Equity question 2

Gas Tax EMS by Gender	Disagree	Neutral	Agree
Male	185	79	34
Female	92	47	15
Total	277	126	49

Gas Tax EMS by Gender	Disagree	Neutral	Agree
Male	62%	27%	11%
Female	60%	31%	10%

Gas Tax EMS by Age	Disagree	Neutral	Agree
Under 25	45	22	4
26 to 55	105	48	21
56 or older	125	58	25
Total	275	128	50

Gas Tax EMS by Age	Disagree	Neutral	Agree
Under 25	63%	31%	6%
26 to 55	60%	28%	12%
56 or older	60%	28%	12%

Gas Tax EMS by Education	Disagree	Neutral	Agree
HS or less	37	14	1
AD or some	93	35	12
BS or grad	145	79	37
Total	275	128	50

Gas Tax EMS by Education	Disagree	Neutral	Agree
HS or less	71%	27%	2%
AD or some	66%	25%	9%
BS or grad	56%	30%	14%

Gas Tax EMS by Location	Disagree	Neutral	Agree
Rural	43	14	6
Urban	108	62	23
Suburban	121	50	20
Total	272	126	49

Gas Tax EMS by Location	Disagree	Neutral	Agree
Rural	68%	22%	10%
Urban	56%	32%	12%
Suburban	63%	26%	10%

Gas Tax EMS by Race	Disagree	Neutral	Agree
CSET	70	30	9
All Others	202	98	40
Total	272	128	49

Gas Tax EMS by Race	Disagree	Neutral	Agree
CSET	64%	28%	8%
All Others	59%	29%	12%

Basic analysis of equity question 3 (High Std Roads) on "*Do you agree that the government should make rural roads safer by converting them to high standard roads given that the costs will be much higher?*" by gender, age, education, location of residence, and race is shown in Table 4.6. Major outcomes include the following: Most males disagree with the proposition that the government should make rural roads safer by converting them to high standard roads given that the cost will be much higher, the percentage is 40%. On the other hand, females' opinion fluctuates between agreeing and being neutral to the proposition in 37% and 36%, respectively. About 38% of people younger than 25 years and older than 56 years disagree that rural roads should be converted to high standard roads. At the same time, people aged 26 to 55 years have an equal percentage of 34% of responses for disagreeing and agreeing with the statement. Most of the respondents with high school or less than high school degree and the respondents with associate degree or some college but no degree disagree with the question while about 38% of the people with bachelor or graduate degree agree with it. Nearly 35% of urban residents are neutral with the proposal while rural and suburban residents disagree. About 41% of CSET recognize that rural roads should be converted into high standard roads while 39% of All Others disagrees. It is interesting to note that none of the percentages were equal or higher than 50% meaning that the opinions for this matter are distributed.

Table 4.6 - Frequency/Percentage for Equity question 3

High Std Roads by Gender	Disagree	Neutral	Agree
Male	120	82	96
Female	42	54	56
Total	162	136	152

High Std Roads by Gender	Disagree	Neutral	Agree
Male	40%	28%	32%
Female	28%	36%	37%

High Std Roads by Age	Disagree	Neutral	Agree
Under 25	27	24	20
26 to 55	59	55	60
56 or older	79	56	72
Total	165	135	152

High Std Roads by Age	Disagree	Neutral	Agree
Under 25	38%	34%	28%
26 to 55	34%	32%	34%
56 or older	38%	27%	35%

High Std Roads by Education	Disagree	Neutral	Agree
HS or less	20	14	18
AD or some	55	49	36
BS or grad	88	73	98
Total	163	136	152

High Std Roads by Education	Disagree	Neutral	Agree
HS or less	38%	27%	35%
AD or some	39%	35%	26%
BS or grad	34%	28%	38%

High Std Roads by Location	Disagree	Neutral	Agree
Rural	25	15	23
Urban	61	66	64
Suburban	72	53	66
Total	158	134	153

High Std Roads by Location	Disagree	Neutral	Agree
Rural	40%	24%	37%
Urban	32%	35%	34%
Suburban	38%	28%	35%

High Std Roads by Race	Disagree	Neutral	Agree
CSET	29	35	45
All Others	132	100	106
Total	161	135	151

High Std Roads by Race	Disagree	Neutral	Agree
CSET	27%	32%	41%
All Others	39%	30%	31%

Basic analysis of equity question 4 (Gas Tax High Std) on "*Do you agree that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads?*" by gender, age, education, location of residence, and race is shown in Table 4.7. Major outcomes include the following: All the demographic groups disagree with the proposition that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads. Regardless of their gender, age or education, or if they agree the government should convert rural roads to high standard roads, the survey respondents disagree with paying extra taxes so it can be invested in making rural roads safer by adding safety measures such as two lanes per direction, a median, barriers and shoulders.

Table 4.7 - Frequency/Percentage for Equity question 4

Gas Tax High Std by Gender	Disagree	Neutral	Agree
Male	186	68	41
Female	84	45	25
Total	270	113	66

Gas Tax High Std by Gender	Disagree	Neutral	Agree
Male	63%	23%	14%
Female	55%	29%	16%

Gas Tax High Std by Age	Disagree	Neutral	Agree
Under 25	42	19	9
26 to 55	102	44	27
56 or older	126	52	29
Total	270	115	65

Gas Tax High Std by Age	Disagree	Neutral	Agree
Under 25	60%	27%	13%
26 to 55	59%	25%	16%
56 or older	61%	25%	14%

Gas Tax High Std by Education	Disagree	Neutral	Agree
HS or less	30	14	7
AD or some	92	31	16
BS or grad	148	70	42
Total	270	115	65

Gas Tax High Std by Education	Disagree	Neutral	Agree
HS or less	59%	27%	14%
AD or some	66%	22%	12%
BS or grad	57%	27%	16%

Gas Tax High Std by Location	Disagree	Neutral	Agree
Rural	40	13	10
Urban	107	57	28
Suburban	118	44	27
Total	265	114	65

Gas Tax High Std by Location	Disagree	Neutral	Agree
Rural	63%	21%	16%
Urban	56%	30%	15%
Suburban	62%	23%	14%

Gas Tax High Std by Race	Disagree	Neutral	Agree
CSET	61	31	16
All Others	206	83	49
Total	267	114	65

Gas Tax High Std by Race	Disagree	Neutral	Agree
CSET	56%	29%	15%
All Others	61%	25%	14%

Basic analysis of equity question 5 (Money Provided) on "*Should more money, less money or about the same amount of money be provided to support urban road and highway improvements?*" by gender, age, education, location of residence, and race is shown in Table 4.8. Major outcomes include the following: About 51% of males think it should be invested about the same amount for transportation improvements. On the opposite, 42% of females think it should be invested more money. A total of 100% of people younger than 25 years believe more money should be invested while people older than 26 think it should be invested the same amount. Respondents with high school degree or less than high school have their opinions divided in 50/50 between investing more money and about the same amount of money. Around 56% of people with associate degree or some college but no degree believes about the same should be invested in roads and highways while 41% of people with bachelor and graduate degree think is should be invested more. Residents of rural, urban and suburban areas all agree it should be invested the same amount of money. All races also believe the same investment should be made for roadway improvements.

Table 4.8 - Frequency/Percentage for Equity question 5

Money Provided by Gender	More Money	Less Money	About the same	No opinion
Male	49	9	79	18
Female	37	4	28	19
Total	86	13	107	37

Money Provided by Gender	More Money	Less Money	About the same	No opinion
Male	32%	6%	51%	12%
Female	42%	5%	32%	22%

Money Provided by Age	More Money	Less Money	About the same	No opinion
Under 25	1	0	0	0
26 to 55	22	4	28	15
56 or older	63	9	79	22
Total	86	13	107	37

Money Provided by Age	More Money	Less Money	About the same	No opinion
Under 25	100%	0%	0%	0%
26 to 55	32%	6%	41%	22%
56 or older	36%	5%	46%	13%

Money Provided by Education	More Money	Less Money	About the same	No opinion
HS or less	3	0	3	0
AD or some	9	4	29	10
BS or grad	77	9	75	27
Total	89	13	107	37

Money Provided by Education	More Money	Less Money	About the same	No opinion
HS or less	50%	0%	50%	0%
AD or some	17%	8%	56%	19%
BS or grad	41%	5%	40%	14%

Money Provided by Location	More Money	Less Money	About the same	No opinion
Rural	13	2	14	6
Urban	41	6	46	13
Suburban	32	4	43	18
Total	86	12	103	37

Money Provided by Location	More Money	Less Money	About the same	No opinion
Rural	37%	6%	40%	17%
Urban	39%	6%	43%	12%
Suburban	33%	4%	44%	19%

Money Provided by Race	More Money	Less Money	About the same	No opinion
CSET	13	2	14	7
All Others	72	11	92	30
Total	85	13	106	37

Money Provided by Race	More Money	Less Money	About the same	No opinion
CSET	36%	6%	39%	19%
All Others	35%	5%	45%	15%

4.2.2 Descriptive Statistics, ANOVA and Regression Models

This section presents the analysis by descriptive statistics and linear regression. The outcome is presented in two tables for each question. The first one is the descriptive statistics explained as follows:

- **N**: the valid number of surveys answered,
- **Mean**: the arithmetic mean of the observations,
- **Std. Dev**: the standard deviation of the observations,
- **COV**: the covariance, which is the ratio between standard deviation and mean,
- **F**: statistic test for one-way ANOVA. It examines if the group means are significantly different,
- **Sig**: level of statistical significance; less than or equal to 0.05 denotes a statistically significant difference among the mean values for each group.

The second table presented is the Linear Regression. The demographic characteristics were the independent variables and the questions were the dependent variables. The regression models were built to examine any significant effects of the independent variables on the equity responses; these models are not intended to be used to forecast people's behavioral response.

The coding for the five questions on transportation equity between urban and rural areas is presented in Table 4.9.

Table 4.9 - Code for the answer options of each equity question

Equity	1	2	3	4	5
Question 1	Far worse	Worse	About the same	Better	Much better
Question 2	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Question 3	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Question 4	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Question 5	Less money		Same amount		More money

For the application of Linear Regression, the variables were transformed into 0 and 1 dummy form to precisely identify each demographic characteristic, as shown in Table 4.10.

For Age we created two dummy variables: Age25 to include respondents younger than 25 years old as 1 and older than 25 as 0, and Age56 to include respondents older than 56 years old as 1, and younger than 56 as 0; here the base group is those older than 25 and younger than 56 years old. For Education, two groups were also created: HSDEG to include respondents with a high school degree or less as 1, and respondents with more than a high school degree as 0. The second Education group was BSDEG to include more educated respondents with a bachelor or graduate degree as 1, and people with less than bachelor's degree as 0; here the base group is those that have some college but no degree or an associate degree. For Location, two dummy variables were created: SUBURB that refers to people that live in the suburban area as 1 and all others as 0, and RURAL that indicated all people that live in rural areas as 1 and all the rest as 0; here the base group is those located in an urban location. Finally, for Race, the CSET group was 1 and all others were 0.

Table 4.10 - Dummy variable for Linear Regression

Gender		Age		Education		Location		Race	
Female	1	Age25	1	HSDEG	1	SUBURB	1	CSET	1
Male	0	> 25	0	> HS	0	Not Suburb	0	All others	0
		Age		**Education**		**Location**			
		Age56	1	BSDEG	1	RURAL	1		
		< 56	0	< BS	0	Not rural	0		

Descriptive statistics analysis shows that the mean response of 2.6 for equity question 1 on "*Compared to urban areas, in rural areas emergency response is*" indicates a perception that response is somewhat worse in rural areas, which is consistent with the estimated travel times in section 4.1 above. The analysis of variance also tested the mean response for various groups, as shown in the last column in Table 4.11. Location was the only variable with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table 4.12 shows that the variables younger than 25 years, older than 56 years ($p<0.11$) and suburban location had significant effects, and all of them are positive

which means that these groups feel more strongly that the rest of the respondents that the EMS response time between urban and rural areas are the same.

Table 4.11 - Equity question 1 descriptive statistics and ANOVA

Compared to urban areas, in rural areas emergency response is:							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		472	2.63	0.754	29%	75.91	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	284	2.63	0.766	29.1%	0.785	0.376
	Female	145	2.57	0.734	28.6%		
Age	Under 25	71	2.76	0.620	22.5%		
	26 to 55	166	2.52	0.744	29.5%	2.818	0.061
	56 or older	194	2.64	0.797	30.2%		
Education	HS or less	50	2.76	0.744	27.0%		
	AD or some	132	2.66	0.780	29.3%	2.116	0.122
	BS or grad	248	2.55	0.735	28.8%		
Location	Rural	63	2.52	0.877	34.8%		
	Urban	182	2.52	0.726	28.8%	5.302	0.005
	Suburban	180	2.76	0.706	25.6%		
Race	CSET	106	2.58	0.804	31.2%	0.337	0.562
	All others	322	2.62	0.731	27.9%		

Table 4.12 - Equity question 1 regression

Compared to urban areas, in rural areas emergency response is			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.191[a]	0.036	0.030	0.739

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	8.655	3	2.885	5.277	.001[b]
Residual	229.066	419	0.547		
Total	237.721	422			

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.422	0.066		36.455	0.000
Age25	0.234	0.106	0.115	2.205	0.028
Age56	0.128	0.079	0.085	1.622	0.106
SUBURB	0.241	0.073	0.159	3.304	0.001

Descriptive statistics analysis shows that the mean response of 2.2 for equity question 2 on "*Do you agree that the government should increase gasoline taxes in order to improve emergency response for rural roads?*" indicates a perception that most of the respondents disagree on paying more for gasoline so the government can collect funds for the improvement of emergency services in rural roads. The analysis of variance also tested the mean response for various groups, as shown in the last column Table 4.13. Gender and Race were the variables with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table 4.14 shows that the variables bachelor or graduate degree and rural location ($p<0.15$) had significant effects. The first variable is positive which means that educated people have the tendency to feel more neutral to the idea of spending more to help reaching transportation equity. The second variable is negative meaning that people that live in rural areas do not want to spend more to get their roads safer.

Table 4.13 - Equity question 2 descriptive statistics and ANOVA

Do you agree that the government should increase gasoline taxes in order to improve emergency response for rural roads?							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		495	2.17	1.078	50%	44.79	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	298	2.17	1.102	50.8%	4.292	0.039
	Female	154	2.16	1.045	48.4%		
Age	Under 25	71	2.15	0.889	41.3%		
	26 to 55	174	2.16	1.145	53.0%	0.179	0.836
	56 or older	208	2.21	1.096	49.6%		
Education	HS or less	52	1.90	0.869	45.7%		
	AD or some	140	1.99	1.076	54.1%	1.704	0.183
	BS or grad	261	2.34	1.103	47.1%		
Location	Rural	63	1.97	1.121	56.9%		
	Urban	193	2.29	1.084	47.3%	0.004	0.996
	Suburban	191	2.14	1.062	49.6%		
Race	CSET	109	2.05	1.057	51.6%	8.744	0.003
	All others	340	2.23	1.086	48.7%		

Table 4.14 - Equity question 2 regression

Do you agree that the government should increase gasoline taxes in order to improve emergency response for rural roads?

R	R Square	Adjusted R Square	Std. Error of the Estimate
.185[a]	0.034	0.030	1.069

	Sum of Squares	df	Mean Square	F	Sig.
Regression	17.898	2	8.949	7.835	.000[b]
Residual	503.687	441	1.142		
Total	521.586	443			

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.995	0.081		24.649	0.000
BSDEG	0.374	0.103	0.170	3.639	0.000
RURAL	-0.216	0.146	-0.069	-1.475	0.141

Descriptive statistics analysis shows that the mean response of 2.9 for equity question 3 on "*Do you agree that the government should make rural roads safer by converting them to high standard roads given that the costs will be much higher?"* indicates a perception that most of the survey participants feel neutral to the idea of converting rural roads into high standard roads. The analysis of variance also tested the mean response for various groups, as shown in the last column Table 4.15. Gender and Education were the variables with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table 4.16 shows that the variables bachelor or graduate degree and CSET had significant effects, and all of them are positive which means that these groups feel more strongly that the rest of the respondents that their opinion is neutral regarding the conversion of rural roads into high standard roads.

Table 4.15 - Equity question 3 descriptive statistics and ANOVA

Do you agree that the government should make rural roads safer by converting them to high standard roads given that the costs will be much higher?							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		491	2.92	1.173	40%	55.25	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	298	2.84	1.195	42.1%	4.541	0.034
	Female	152	3.08	1.095	35.6%		
Age	Under 25	71	2.86	1.018	35.6%		
	26 to 55	174	2.95	1.174	39.8%	0.618	0.540
	56 or older	207	2.89	1.222	42.3%		
Education	HS or less	52	2.90	1.176	40.6%		
	AD or some	140	2.77	1.127	40.7%	4.600	0.011
	BS or grad	259	3.00	1.176	39.2%		
Location	Rural	63	2.94	1.243	42.3%		
	Urban	191	2.94	1.182	40.2%	0.035	0.966
	Suburban	191	2.93	1.135	38.7%		
Race	CSET	109	3.20	1.145	35.8%	0.065	0.798
	All others	338	2.83	1.159	41.0%		

Table 4.16 - Equity question 3 regression

Do you agree that the government should make rural roads safer by converting them to high standard roads given that the costs will be much higher?					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		
.168[a]	0.028	0.024	1.147		
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	16.913	2	8.456	6.426	.002[b]
Residual	581.640	442	1.316		
Total	598.553	444			
	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.711	0.091		29.871	0.000
BSDEG	0.201	0.110	0.086	1.826	0.069
CSET	0.409	0.127	0.151	3.215	0.001

Descriptive statistics analysis shows that the mean response of 2.3 for equity question 4 on "*Do you agree that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads?"* indicates a perception that most of the respondents disagree on paying more for gasoline so the government can collect funds to invest on making rural roads safer. The analysis of variance also tested the mean response for various groups, as shown in the last column Table 4.17. Location was the only variable with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table 4.18 shows that the variable bachelor or graduate degree ($p<0.08$) had significant effect, and it is positive which means that this group feel more strongly that the rest of the respondents that it is neutral their opinion on the government raising gasoline taxes to improve rural roads.

Table 4.17 - Equity question 4 descriptive statistics and ANOVA

Do you agree that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads?							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		490	2.26	1.1	49%	45.45	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	295	2.20	1.096	49.8%	0.013	0.910
	Female	154	2.35	1.100	46.8%		
Age	Under 25	70	2.30	1.012	44.0%		
	26 to 55	173	2.27	1.135	50.0%	0.152	0.859
	56 or older	207	2.21	1.099	49.7%		
Education	HS or less	57	2.22	1.064	47.9%		
	AD or some	139	2.12	1.050	49.5%	6.680	0.001
	BS or grad	260	2.33	1.121	48.1%		
Location	Rural	63	2.19	1.162	53.1%		
	Urban	192	2.29	1.124	49.1%	2.371	0.095
	Suburban	189	2.24	1.063	47.5%		
Race	CSET	108	2.23	1.116	50.0%	2.386	0.123
	All others	338	2.26	1.094	48.4%		

Table 4.18 - Equity question 4 regression

Do you agree that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads?

R	R Square	Adjusted R Square	Std. Error of the Estimate
.085[a]	0.007	0.005	1.093

	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.907	1	3.907	3.274	.071[b]
Residual	534.717	448	1.194		
Total	538.624	449			

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.142	0.079		27.027	0.000
BSDEG	0.189	0.104	0.085	1.809	0.071

Descriptive statistics analysis shows that the mean response of 3.7 for equity question 5 on "*Should more money, less money or about the same amount of money be provided to support urban road and highway improvements?"* indicates a perception that most of the respondents agree on providing the same amount of money to support road improvements. The analysis of variance also tested the mean response for various groups, as shown in the last column Table 4.20. None of the variables got significant mean responses ($p<0.05$), but gender and education got ($p<0.17$). The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table 4.21 shows that the variables female and bachelor or graduate degree had significant effects, and they are all positive which means that this group feel more strongly that the rest of the respondents that the government should invest the same amount or even more money to the support of road improvements.

Table 4.19 - Equity question 5 descriptive statistics and ANOVA

Should more money, less money or about the same amount of money be provided to support urban road and highway improvements?							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		227	3.71	1.205	32%	46.42	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	155	3.17	1.591	50.2%	1.907	0.168
	Female	88	3.10	1.960	63.2%		
Age	Under 25	1	5.00		0.0%		
	26 to 55	69	2.87	1.870	65.2%	0.208	0.812
	56 or older	173	3.24	1.663	51.3%		
Education	HS or less	6	4.00	1.095	27.4%		
	AD or some	52	2.62	1.623	61.9%	1.792	0.168
	BS or grad	188	3.29	1.474	44.8%		
Location	Rural	35	3.11	1.827	58.7%		
	Urban	106	3.29	1.679	51.0%	0.206	0.814
	Suburban	97	3.02	1.785	59.1%		
Race	CSET	36	3.03	1.874	61.8%	0.056	0.812
	All others	205	3.16	1.711	54.1%		

Table 4.20 - Equity question 5 regression

Should more money, less money or about the same amount of money be provided to support urban road and highway improvements?					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		
.228[a]	0.052	0.042	1.169		
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	15.161	2	7.581	5.548	.005[b]
Residual	277.363	203	1.366		
Total	292.524	205			
	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	3.209	0.178		18.005	0.000
Female	0.372	0.173	0.147	2.154	0.032
BSDEG	0.489	0.193	0.173	2.537	0.012

4.3 Rural Safety Perceptions Questions

The data analysis for the rural safety perceptions question was made based on the equity questions. The coding for the eight questions on rural safety is presented in Table 4.21.

Table 4.21- Code for the answer options for the rural safety questions

Rural Safety	1	2	3	4	5
Question	Not a problem at all		Moderate problem		Big problem

The tables for basic analysis and descriptive statistics analysis are presented in Appendix B. Each of the eight questions is showed next with their due analysis.

1) Please rate these travel conditions on rural roads: Ambulance response to emergencies

Basic analysis of rural safety perception question 1 (EMS) on "*Please rate these travel conditions on rural roads: Ambulance response to emergencies*" by gender, age, education, location of residence, and race is shown in Table II.1. Major outcomes include the following: About 47% of males think the ambulance response to emergencies is not a problem at all. On the opposite, 57% of females think it is a moderate problem. All age groups agree the travel condition is a moderate problem. Respondents with high school degree or less than high school think it is not a problem while all other respondents with higher degrees feel it is a moderate problem. Around 45% of urban residents think EMS response in rural areas is not a problem while suburban and rural residents agree it is a moderate problem. Regarding races, 43% of CSET think the statement is not a problem and on the other hand 49% of All Others believe is it a moderate problem.

Descriptive statistics analysis shows that the mean response of 2.7 for equity question 1 on "*Please rate these travel conditions on rural roads: Ambulance response to emergencies"* indicates a perception that most of the survey participants feel that it is

a moderate problem. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.2. Gender was the only variable with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.3 shows that the variable female had significant effects, and it is positive which means that this group feels more strongly than the rest of the respondents that ambulance response to emergencies is a moderate problem in rural roads.

2) Please rate these travel conditions on rural roads: Cell phone reception for emergency calls

Basic analysis of rural safety perception question 2 (Cell Phone) on "*Please rate these travel conditions on rural roads: Cell phone reception for emergency calls*" by gender, age, education, location of residence, and race is shown in Table II.4. Major outcomes include the following: Around 53% of males believe cell phone reception for emergency calls in rural areas is not a problem while 42% of females agree it is a moderate problem. In addition, respondents of all age groups, all degree levels, from different locations and participants with different races all agree the statement is not a problem at all.

Descriptive statistics analysis shows that the mean response of 2.5 for equity question 2 on "*Please rate these travel conditions on rural roads: Cell phone reception for emergency calls"* indicates a perception that most of the survey participants feel that the travel condition is not a problem to a moderate problem. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.5. Location and Race were the variables with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.6 shows that the variables female, rural residents and CSET had significant effects, and all of them are positive which means that these groups feel more strongly

than the rest of the respondents that cell phone reception is more a moderate problem than not a problem in rural roads.

3) Please rate these travel conditions on rural roads: Access to public transportation

Basic analysis of rural safety perception question 3 (Public Transport) on "*Please rate these travel conditions on rural roads: Access to public transportation*" by gender, age, education, location of residence, and race is shown in Table II.7. Major outcomes include the following: Most of the survey respondents agree that the access to public transportation in rural areas in Hawaii is not a problem regardless of their demographic characteristics.

Descriptive statistics analysis shows that the mean response of 2.7 for equity question 3 on "*Please rate these travel conditions on rural roads: Access to public transportation"* indicates a perception that most of the survey participants believe public transportation is not a problem to a moderate problem in Hawaii. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.8. Education is the only variable with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.9 shows that the variables female ($p<0.12$) and bachelor or graduate degree had significant effects, and all of them are positive which means that these groups feel more strongly than the rest of the respondents that access to public transportation in rural areas is more of a moderate problem than not a problem at all.

4) Please rate these travel conditions on rural roads: Road condition of state highways

Basic analysis of rural safety perception question 4 (Road Condition) on "*Please rate these travel conditions on rural roads: Road condition of state highways*" by gender, age, education, location of residence, and race is shown in Table II.10. Major outcomes

include the following: More than 50% of each demographic group respondents considered road conditions of state highways in rural Hawaii a big problem.

Descriptive statistics analysis shows that the mean response of 3.8 for equity question 4 on "*Please rate these travel conditions on rural roads: Road condition of state highways"* indicates a perception that most of the survey participants feel the statement is a big problem on rural roads. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.11. Location was the only variable with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.12 shows that the variables younger than 25, high school degree or less ($p<0.10$), suburban residents and rural residents had significant effects, and all of them are positive except for respondents younger than 25, which means that this group feel more strongly that it is a moderate problem while the other significant variables think it is more of a big problem.

5) Please rate these travel conditions on rural roads: Hidden, missing or defaced traffic signs

Basic analysis of rural safety perception question 5 (Traffic Signs) on "*Please rate these travel conditions on rural roads: Hidden, missing or defaced traffic signs*" by gender, age, education, location of residence, and race is shown in Table II.13. Major outcomes include the following: Both male and female believe hidden, missing or defaced traffic signs in rural roads are a moderate problem. Regarding Age, all groups disagree from each other. Respondents younger than 25 consider the travel condition not a problem, respondents with ages between 25 and 56 think it is a moderate problem, and respondents older than 56 agree it is a big problem. Participants with high school degree or less than high school feel the statement is a big problem while participants with higher degree levels agree it is a moderate problem. Respondents from all locations and all races believe the travel condition is a moderate problem.

Descriptive statistics analysis shows that the mean response of 3.1 for equity question 5 on "*Please rate these travel conditions on rural roads: Hidden, missing or defaced traffic signs"* indicates a perception that most of the survey participants feel the travel condition is a moderate problem. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.14. Age was the only variable with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.15 shows that the variables younger than 25 ($p<0.06$), older than 56 and CSET had significant effects, and all of them are positive except participants younger than 25 years old, which means that this last group believe it is not a problem while the other significant variables feel more strongly than the rest of the respondents that it is a moderate problem.

6) Please rate these travel conditions on rural roads: Faded or worn out lane markings

Basic analysis of rural safety perception question 6 (Lane Markings) on "*Please rate these travel conditions on rural roads: Faded or worn out lane markings*" by gender, age, education, location of residence, and race is shown in Table II.16. Major outcomes include the following: Most of the survey respondents regardless their demographic characteristic feel that faded or worn out lane markings are a big problem in rural areas in the state of Hawaii.

Descriptive statistics analysis shows that the mean response of 3.5 for equity question 6 on "*Please rate these travel conditions on rural roads: Faded or worn out lane markings"* indicates a perception that most of the survey participants agree it is a big problem. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.17. None of the variables got significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.18 shows that the variables younger than 25, bachelor or graduate degree ($p<0.11$) and CSET ($p<0.12$) had significant effects. The

young respondents and the educated ones had negative effects meaning that they feel faded or worn out lane markings is a moderate problem while CSET had a positive effect meaning they think it is a big problem.

7) Please rate these travel conditions on rural roads: No traffic lights at rural intersections

Basic analysis of rural safety perception question 7 (Traffic Light) on "*Please rate these travel conditions on rural roads: No traffic lights at rural intersections*" by gender, age, education, location of residence, and race is shown in Table II.19. Major outcomes include the following: Almost all the participants consider the lack of traffic lights at rural intersections not a problem in Hawaii except respondents with high school degree or less than high school that think it is a moderate problem.

Descriptive statistics analysis shows that the mean response of 2.7 for equity question 7 on "*Please rate these travel conditions on rural roads: No traffic lights at rural intersections"* indicates a perception that most of the survey participants feel it is not a problem to a moderate problem. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.20. Age and Location were the variables with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.21 shows that the variables younger than 25 ($p<0.16$), older than 56, rural residents and CSET had significant effects. Respondents younger than 25 and rural residents got negative effects meaning they believe more strongly than the rest of the respondents that the statement is not a problem while participants older than 56 and CSET had positive effects meaning they believe it is a moderate problem.

8) Please rate these travel conditions on rural roads: Lighting at night

Basic analysis of rural safety perception question 8 (Night Light) on "*Please rate these travel conditions on rural roads: Lighting at night*" by gender, age, education,

location of residence, and race is shown in Table II.22. Major outcomes include the following: Both males and females feel lighting at night is a big problem in rural roads. Concerning Age, respondents younger than 25 years old think the travel conditions is not a problem, respondents with ages between 25 and 56 years old agree it is a moderate problem, and participants older than 56 feel it is a big problem. Respondents with all education degree levels consider it is a big problem. Regarding Location, of urban residents and 43% of suburban residents agree the statement is a big problem while rural residents think lighting at night is not a problem at all in rural roads. CSET respondents have the opinion that the travel condition is a moderate problem. In the other hand, All Others believe it is a big problem.

Descriptive statistics analysis shows that the mean response of 3.2 for equity question 8 on "*Please rate these travel conditions on rural roads: Lighting at night"* indicates a perception that most of the survey participants believe it is a moderate problem. The analysis of variance also tested the mean response for various groups, as shown in the last column Table II.23. Gender and Race were the variables with significantly ($p<0.05$) mean responses. The effect of the independent variables was tested in linear regression models and only variables with significant coefficient estimates were retained in the model specification. Table II.24 shows that the variables female, rural residents ($p<0.11$) and CSET had significant effects. Female respondents and CSET had positive effects so they feel that it is more of a big problem than the others while rural residents presented a negative effect meaning they think it a more of a moderate problem.

5 Conclusion

The University of Hawaii in collaboration with the universities of Alaska, Idaho and Washington received funding for a Tier-1 University Transportation Center from the U.S. Department of Transportation, called the Center for Safety Equity in Transportation (CSET). Their research focus is on transportation safety equity for rural, isolated, tribal and indigenous communities (RITI communities). CSET's goal is to offer a safe and efficient transportation system to RITI communities while preserving the culture and making sure that those with restricted travel alternatives are accounted for.

The RITI community in Hawaii is the native Hawaiians and part Hawaiians and Pacific Islanders; many of them live in rural areas. Hawaii does not have Indian reservations, but there are a few rural locations where there is a higher percentage of CSET minorities (e.g., Waianae, Waimanalo.) There are a significant number of fatal crashes involving minorities in Hawaii and considering all CSET states, Hawaii presented the highest amount of those fatalities.

The objective of the research in this thesis is to get an initial understanding about the perceptions of minority groups and all others on urban and rural transportation equity, while correlating with demographic characteristics such as gender, age and education.

The methodology consisted on the literature review of topics such as equity, minorities, transportation equity, traffic safety equity and emergency medical services response time. With the findings from this review, a survey was created in order to reach out to the minority groups in Hawaii to try to understand what they think about transportation equity and rural safety transportation in the state. The survey was divided in three parts: transportation, rural transportation and demographics. The first part asked the respondents to answer question such as how long they commute per day, their behavior while driving, their opinion about the current traffic in Hawaii, and about traffic accidents. The second part focused on rural roads and asked to rank travel conditions, vehicles behaviors, and connectivity. Also, this part had an empty box for additional comments about risky behaviors or risky conditions on rural roads. The third

and last part, the demographics, requested information such as gender, age, education, employment status, ZIP code of residence, and race.

The survey's data analysis was made by comparing the results with socio-demographic characteristics of the respondents. Five transportation equity-related questions were chosen from the big survey plus the perception of eight travel conditions for rural safety. The statement of each chosen question is showed on the first column of Table 5.1.

The analysis of the survey responses is summarized in Table 5.1.

Table 5.1 - Summarized responses

Survey Question	Overall Response
(Equity 1) Compared to urban areas, in rural areas emergency response is:	About the same
(Equity 2) Do you agree that the government should increase gasoline taxes in order to improve emergency response for rural roads?	Disagree
(Equity 3) Do you agree that the government should make rural roads safer by converting them to high standard roads given that the costs will be much higher?	Disagree
(Equity 4) Do you agree that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads?	Disagree
(Equity 5) Should more money, less money or about the same amount of money be provided to support urban road and highway improvements?	Same amount
(Rural Safety 1) Ambulance response to emergencies	Moderate problem
(Rural Safety 2) Cell phone reception for emergency calls	Not a problem at all
(Rural Safety 3) Access to public transportation	Not a problem at all
(Rural Safety 4) Road condition of state highways	Big problem
(Rural Safety 5) Hidden, missing or defaced traffic signs	Moderate problem
(Rural Safety 6) Faded or worn out lane markings	Big problem
(Rural Safety 7) No traffic lights at rural intersections	Not a problem at all
(Rural Safety 8) Lighting at night	Big problem

Table 5.1 shows people's perception on the survey questions regardless of their socio-demographic characteristics. As we can see, the respondents think EMS response is about the same when comparing urban and rural areas, but analysis of FARS records over ten years in section 4.1 indicate that EMS response time in rural roads is substantially longer than in urban roads. (This could be one of the reasons why more people die in fatal crashes in rural areas compared to urban areas).

The respondents disagreed with (1) paying more taxes in order to improve EMS response in rural areas (2) having the government convert rural roads into high standard roads to make them safer, and (3) paying more taxes so the government can raise the standard on rural roads. The outcome of the last question regarding transportation equity is that the same amount of money should be provided to support urban roads and highway improvements. This is an important finding to investigate further with the full survey, given that rural areas receive a small fraction of the highway budget.

The results for the rural safety perception analysis was that the participants consider that the following are not a problem at all in rural Hawaii: (1) cell phone reception for emergency calls, (2) access to public transportation, and (3) absence of signalized intersections. Ambulance response to emergencies in rural roadways, and hidden, missing or defaced traffic signs the respondents were perceived as moderately problematic. Faded or worn out lane markings, and lighting at night, were perceived as problematic. These are important findings to investigate further with the full survey, and lead to recommendation for higher quality (basic) rural road infrastructure (pavements, markings and lights).

The findings of significant correlations between the equity/safety responses on the one hand and the respondents' demographic characteristics on the other hand are summarized below.

Female respondents felt that more money should be provided to highway improvements in rural areas while most of the respondents thought the same should be provided. They felt that EMS response is a big problem while the majority agreed it is a moderate problem. Females thought cell phone reception are moderate problem in rural areas while the others felt it is not a problem at all. They felt more than the others that lighting at night is a big problem in rural roads.

Participants younger than 25 years old felt more than the others that EMS response is about the same comparing rural and urban areas in Hawaii. They did not feel that rural road conditions, missing traffic signs, and faded lane markings are

problems. These responses indicate a lack of maturity in assessing prevailing conditions, which is consistent with the young age of this group.

Respondents older than 56 felt more than the others that missing traffic signs are a problem. They also felt that no traffic lights at rural intersections are problematic while all others believed it is not a problem. These responses are consistent with the more conservative behavior of these older respondents.

Highly educated respondents were the only group that was neutral regarding the government increasing gas taxes in order to improve EMS response on rural roads. Egalitarianism is more common among highly educated people; thus, this finding is consistent with their expected behavior. Also consistent with egalitarianism is that they believe access to public transportation is a moderate problem in rural areas while less educated people think that this is not a problem.

Suburban residents felt more than the others that EMS response in rural and urban areas is about the same. This is the group that primarily skewed the responses to be less consistent with the FARS findings. Also, they felt more than the others that the road condition of state highways is a big problem.

Rural residents felt that cell phone reception is a moderate problem compared to the overall result of being not a problem. They also felt more than the others that the road condition of state highways is a big problem. Rural residents felt more than the others that the absence of traffic lights at rural intersections is not a problem at all: Their familiarity with unsignalized intersections allows them to use them with ease, as opposed to urban and suburban respondents whose familiarity with signals make them fell that are needed at rural junctions.

Last but not least, CSET respondents displayed five positive significant effects. The minority group of respondents felt that the government should convert rural roads into high standard roads in order to increase safety. They felt that cell phone reception and the lack of traffic lights are moderate problems whereas the average response is that they are not. They felt more than the others that missing traffic signs is a moderate problem. They felt more than the others that lighting at night is a big problem.

The full study is expected to have over 3,000 responses and will be the base for finalized recommendations. This initial assessment included many “nonrandom” groups and consisted mostly of taxi and bus drivers, and UH students. Based on the preliminary outputs, recommendations for urban roads include improving road conditions of state highways, refining lane markings and providing lighting at night. In addition, Kumfer et al. [21] developed an online tool to educate drivers about rural roads and driver behavior, particularly for teen drivers who typically have poor or undeveloped rural road safety awareness (which results in a high percentage of crashes involving people of young age.) Their tool measures the before and after perceptions of the participants and assesses whether they learned something. Their tool could be adopted in Hawaii and could become a part of the writing test for driver’s license on the neighboring islands which are mostly rural.

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I. APPENDIX A: SURVEY

Part 1: Transportation Survey

1) Do you have a Driver's License?

[ ] Yes, go to Question 2. [ ] No, go to Question 3.

2) How many years of driving experience do you have? _____

3) How many cars, vans, or pickups are available to your household or immediate family?

[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 or more

4) How many of these are pickup trucks or large SUV?

[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 or more

5) On a typical day, which of these transportation options do you use to commute?

[ ] Car, as a driver [ ] Car, as a passenger [ ] Walk (your main trip is on foot)

[ ] Bicycle [ ] Motorcycle [ ] Bus

[ ] Other (Please Specify): _____

6) On a typical day, how many miles do you commute to work or school? _____

7.a) On a typical day, how many minutes do you commute to work or school? _____

7.b) On a typical day, how many minutes do you commute back to your home? _____

8) Is traffic congestion a problem during busy times of the day?

	1. Not a problem at all	2.	3. Moderate problem	4.	5. Big problem
At the area around your work or school	[ ]	[ ]	[ ]	[ ]	[ ]
At the area around your residence	[ ]	[ ]	[ ]	[ ]	[ ]
On your island	[ ]	[ ]	[ ]	[ ]	[ ]

9) In the last two weeks how many trips did you drive at night?

[ ] Never [ ] 1 – 4 [ ] 5 – 10 [ ] More than 10

10) Hawaii does not have a motorcycle helmet law. Should it have a law?

[ ] Yes [ ] No [ ] Do not know

11) What do you think about those who drink and drive in Hawaii?

[ ] 1. Not a problem at all [ ] 2. [ ] 3. Moderate problem [ ] 4. [ ] 5. Big problem [ ] 6. Do not know

12) What do you think about the blood alcohol level in Hawaii?

[ ] 1. Too low [ ] 2. [ ] 3. About right [ ] 4. [ ] 5. Too high [ ] 6. Do not know

13) How often do you do the following while driving?

	Always	Often	Sometimes	Rarely	Never
Listen to the radio	[ ]	[ ]	[ ]	[ ]	[ ]
Listen to CD, iPod, or Podcasts	[ ]	[ ]	[ ]	[ ]	[ ]
Change CDs, DVDs, or Tapes	[ ]	[ ]	[ ]	[ ]	[ ]
Think about work and things you need to do	[ ]	[ ]	[ ]	[ ]	[ ]
Talk or interact with children in the back seat	[ ]	[ ]	[ ]	[ ]	[ ]
Talk to other passengers in the vehicle	[ ]	[ ]	[ ]	[ ]	[ ]
Travel with an animal companion	[ ]	[ ]	[ ]	[ ]	[ ]
Eat	[ ]	[ ]	[ ]	[ ]	[ ]
Drink (Water, coffee, tea, soda, etc.)	[ ]	[ ]	[ ]	[ ]	[ ]
Make or take phone calls	[ ]	[ ]	[ ]	[ ]	[ ]
Read e-mails or text messages	[ ]	[ ]	[ ]	[ ]	[ ]
Send e-mails or text messages	[ ]	[ ]	[ ]	[ ]	[ ]
Surf the net or social media	[ ]	[ ]	[ ]	[ ]	[ ]
Put on make-up in traffic or at stop lights	[ ]	[ ]	[ ]	[ ]	[ ]
Read a book, newspaper, iPad, or Kindle	[ ]	[ ]	[ ]	[ ]	[ ]
Use GPS or map service	[ ]	[ ]	[ ]	[ ]	[ ]
Multitask two or more of these activities in one trip	[ ]	[ ]	[ ]	[ ]	[ ]

14) During the past 12 months:

	Yes	No
a) Have you been stopped by the Police?	[ ]	[ ]
b) Were you issued a citation?	[ ]	[ ]
c) Have you had a DUI?	[ ]	[ ]
d) Have you been involved in a traffic accident?	[ ]	[ ]
If YES, did any of these accidents involve your cell phone use?	[ ]	[ ]
If YES, did any of these accidents involve someone else's cell phone use?	[ ]	[ ]

15) Please give us your opinion on the five urban-rural road questions below:

15.a) Think about emergency response for traffic accidents such as police, ambulance and fire truck. Compared to urban areas, in rural areas emergency response is:

[ ] 1. Far worse [ ] 2. Worse [ ] 3. About the same [ ] 4. Better [ ] 5. Much better

15.b) Do you agree that the government should increase gasoline taxes in order to improve emergency response for rural roads?

[ ] 1. Strongly disagree [ ] 2. Disagree [ ] 3. Neutral [ ] 4. Agree [ ] 5. Strongly agree

15.c) There are more fatal crashes on rural roads than on urban roads. High standard roads like freeways are the safest. Building high standard rural roads with two lanes per direction, a median, barriers and shoulders is much safer but costs a lot more.

Do you agree that the government should make rural roads safer by converting them to high standard roads given that the costs will be much higher?

[ ] 1. Strongly disagree [ ] 2. Disagree [ ] 3. Neutral [ ] 4. Agree [ ] 5. Strongly agree

15.d) Do you agree that the government should raise gasoline taxes to collect funds to make rural roads safer by converting them to high standard roads?

[ ] 1. Strongly disagree [ ] 2. Disagree [ ] 3. Neutral [ ] 4. Agree [ ] 5. Strongly agree

15.e) Should more money, less money or about the same amount of money be provided to support urban road and highway improvements?

[ ] More money [ ] Less money [ ] About the same [ ] No opinion

Part 2: Rural Transportation Survey

1) Please rate these travel conditions on rural roads:

	1. Not a problem at all	2.	3. Moderate problem	4.	5. Big problem
Ambulance response to emergencies	[ ]	[ ]	[ ]	[ ]	[ ]
Cell phone reception for emergency calls	[ ]	[ ]	[ ]	[ ]	[ ]
Access to public transportation	[ ]	[ ]	[ ]	[ ]	[ ]
Road condition of state highways	[ ]	[ ]	[ ]	[ ]	[ ]
Hidden, missing or defaced traffic signs	[ ]	[ ]	[ ]	[ ]	[ ]
Faded or worn out lane markings	[ ]	[ ]	[ ]	[ ]	[ ]
No traffic lights at rural intersections	[ ]	[ ]	[ ]	[ ]	[ ]
Lighting at night	[ ]	[ ]	[ ]	[ ]	[ ]
Speed limits are low	[ ]	[ ]	[ ]	[ ]	[ ]
Narrow shoulders or no shoulders	[ ]	[ ]	[ ]	[ ]	[ ]
Winding roads	[ ]	[ ]	[ ]	[ ]	[ ]
Stopping to turn left into driveways	[ ]	[ ]	[ ]	[ ]	[ ]
Slowing down to turn right into driveways	[ ]	[ ]	[ ]	[ ]	[ ]
Farm driveways	[ ]	[ ]	[ ]	[ ]	[ ]
Animal crossings	[ ]	[ ]	[ ]	[ ]	[ ]
Driving at night	[ ]	[ ]	[ ]	[ ]	[ ]
Driving when roads are wet	[ ]	[ ]	[ ]	[ ]	[ ]

2) Please rate these vehicles and behaviors on rural roads:

	1. Not a problem at all	2.	3. Moderate problem	4.	5. Big problem
Seatbelt use is low	[ ]	[ ]	[ ]	[ ]	[ ]
Farm vehicles or equipment on the highway	[ ]	[ ]	[ ]	[ ]	[ ]
Large trucks and buses	[ ]	[ ]	[ ]	[ ]	[ ]
Drivers speeding	[ ]	[ ]	[ ]	[ ]	[ ]
Drivers overtaking	[ ]	[ ]	[ ]	[ ]	[ ]
Drivers stopping or blocking lanes	[ ]	[ ]	[ ]	[ ]	[ ]
Impaired drivers (alcohol, etc.)	[ ]	[ ]	[ ]	[ ]	[ ]
Distracted drivers (texting, etc.	[ ]	[ ]	[ ]	[ ]	[ ]
Unlicensed drivers (young teens)	[ ]	[ ]	[ ]	[ ]	[ ]
Single Motorcyclists	[ ]	[ ]	[ ]	[ ]	[ ]
Groups of Motorcyclists	[ ]	[ ]	[ ]	[ ]	[ ]
Single bikers	[ ]	[ ]	[ ]	[ ]	[ ]
Groups of bikers	[ ]	[ ]	[ ]	[ ]	[ ]
Sports events that use rural roads	[ ]	[ ]	[ ]	[ ]	[ ]
Tourists driving erratically	[ ]	[ ]	[ ]	[ ]	[ ]

3) Please add your comments about risky behaviors or risky conditions on rural roads:

_____

_____

4) How do you get information on the condition of rural roads?

[ ] Radio [ ] TV [ ] Newspaper, printed
[ ] Email [ ] Facebook [ ] Twitter
[ ] Online websites [ ] Word of mouth
[ ] Other (Please Specify): _____

5) In rural areas, what do you think about connectivity?

5.a) Cell phone:

	1. Very bad	2.	3. Neutral	4.	5. Very Good
Cell phone signal strength for calls	[ ]	[ ]	[ ]	[ ]	[ ]
Data limits by providers	[ ]	[ ]	[ ]	[ ]	[ ]
Internet speed	[ ]	[ ]	[ ]	[ ]	[ ]
Cost of internet service	[ ]	[ ]	[ ]	[ ]	[ ]
Service availability	[ ]	[ ]	[ ]	[ ]	[ ]

5.b) Home:

	1. Very bad	2.	3. Neutral	4.	5. Very Good
Availability of internet	[ ]	[ ]	[ ]	[ ]	[ ]
Internet speed	[ ]	[ ]	[ ]	[ ]	[ ]
Download speed	[ ]	[ ]	[ ]	[ ]	[ ]
Cost of internet service	[ ]	[ ]	[ ]	[ ]	[ ]
Unreliable connection	[ ]	[ ]	[ ]	[ ]	[ ]
Electric power interruptions	[ ]	[ ]	[ ]	[ ]	[ ]

Part 3: Demographic Survey

1) What is your gender?

[ ] Male [ ] Female

2) What is your age?

[ ] Under 15 [ ] 15 - 25 [ ] 26 - 35
[ ] 36 - 45 [ ] 46 - 55 [ ] 56 - 65
[ ] 66 - 75 [ ] 76 or older

3) What is your marital status?

[ ] Single [ ] Married [ ] Widowed [ ] Divorced or Separated

4) What is the highest level of school you have completed or the highest degree you have received?

[ ] Less than high school degree [ ] High school degree or equivalent [ ] Some college but no degree
[ ] Associate degree [ ] Bachelor's degree [ ] Graduate degree

5) Which of the following categories best describes your main current status?

[ ] Employed full-time [ ] Employed part-time [ ] Not employed
[ ] Retired [ ] Student [ ] Disabled, not able to work

6) If you work full or part-time, your employment is in:

[ ] Public sector – City or County [ ] Public sector – State [ ] Public sector – Federal

[ ] Private sector – Small business with 1 to 99 employees [ ] Private sector – Medium-sized business with 100 to 499 employees [ ] Private sector – Large business with 500 employees or more

[ ] Self-employed

7) What's the zip code at your place of residence? _____

8) Your place of residence is this type of area...

[ ] Rural [ ] Urban [ ] Suburban

9) What's the zip code at your place of work or school? _____

10) Which race best describes you? Please mark one box.

[ ] Native Hawaiian or part Hawaiian [ ] Guamanian or Chamorro [ ] Samoan
[ ] Other Pacific Islander [ ] White [ ] African American or Black
[ ] American Indian or Alaska Native [ ] Asian Indian [ ] Chinese
[ ] Filipino [ ] Japanese [ ] Korean
[ ] Hispanic/Latino [ ] Vietnamese [ ] Other Asian
[ ] Other

11) Are there other races that also describe you? If yes, please add them in the box below.

_____

II. APPENDIX B: Rural Safety Perceptions Questions

1) Please rate these travel conditions on rural roads: Ambulance response to emergencies

Table II.1 - Basic statistics of responses: Rural Safety Perception 1

EMS by Gender	Not a problem at all	Moderate problem	Big problem
Male	108	84	38
Female	29	64	20
Total	137	148	58

EMS by Gender	Not a problem at all	Moderate problem	Big problem
Male	47%	37%	17%
Female	26%	57%	18%

EMS by Age	Not a problem at all	Moderate problem	Big problem
Under 25	22	23	7
26 to 55	52	60	15
56 or older	62	66	35
Total	136	149	57

EMS by Age	Not a problem at all	Moderate problem	Big problem
Under 25	42%	44%	13%
26 to 55	41%	47%	12%
56 or older	38%	40%	21%

EMS by Education	Not a problem at all	Moderate problem	Big problem
HS or less	18	14	8
AD or some	45	48	17
BS or grad	74	88	33
Total	137	150	58

EMS by Education	Not a problem at all	Moderate problem	Big problem
HS or less	45%	35%	20%
AD or some	41%	44%	15%
BS or grad	38%	45%	17%

EMS by Location	Not a problem at all	Moderate problem	Big problem
Urban	61	51	25
Suburban	55	73	21
Rural	18	24	11
Total	134	148	57

EMS by Location	Not a problem at all	Moderate problem	Big problem
Urban	45%	37%	18%
Suburban	37%	49%	14%
Rural	34%	45%	21%

EMS by Race	Not a problem at all	Moderate problem	Big problem
All Others	110	105	40
CSET	26	43	18
Total	136	148	58

EMS by Race	Not a problem at all	Moderate problem	Big problem
All Others	43%	41%	16%
CSET	30%	49%	21%

Table II.2 - Descriptive Statistics and ANOVA: Rural Safety Perception 1

Ambulance response to emergencies							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		346	2.66	1.103	41%	44.91	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	230	2.57	1.137	44.2%	4.152	0.042
	Female	113	2.83	1.026	36.3%		
Age	Under 25	52	2.62	0.973	37.1%	0.678	0.508
	26 to 55	127	2.58	1.035	40.1%		
	56 or older	163	2.73	1.197	43.8%		
Education	HS or less	40	2.75	1.104	40.1%	0.386	0.680
	AD or some	110	2.59	1.095	42.3%		
	BS or grad	195	2.68	1.113	41.5%		
Location	Rural	53	2.75	1.191	43.3%	0.251	0.778
	Urban	137	2.63	1.201	45.7%		
	Suburban	149	2.66	0.984	37.0%		
Race	CSET	87	2.77	1.198	43.2%	1.136	0.287
	All others	255	2.62	1.076	41.1%		

Table II.3 - Regression: Rural Safety Perception 1

Ambulance response to emergencies					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		
.110[a]	0.012	0.009	1.102		
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	5.042	1	5.042	4.152	.042[b]
Residual	414.049	341	1.214		
Total	419.090	342			
	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.574	0.073		35.425	0.000
Female	0.258	0.127	0.110	2.038	0.042

2) Please rate these travel conditions on rural roads: Cell phone reception for emergency calls

Table II.4 - Basic statistics of responses: Rural Safety Perception 2

Cell Phone by Gender	Not a problem at all	Moderate problem	Big problem
Male	123	65	44
Female	41	47	24
Total	164	112	68

Cell Phone by Gender	Not a problem at all	Moderate problem	Big problem
Male	53%	28%	19%
Female	37%	42%	21%

Cell Phone by Age	Not a problem at all	Moderate problem	Big problem
Under 25	26	19	8
26 to 55	62	36	29
56 or older	77	56	31
Total	165	111	68

Cell Phone by Age	Not a problem at all	Moderate problem	Big problem
Under 25	49%	36%	15%
26 to 55	49%	28%	23%
56 or older	47%	34%	19%

Cell Phone by Education	Not a problem at all	Moderate problem	Big problem
HS or less	21	14	6
AD or some	57	32	24
BS or grad	88	67	38
Total	166	113	68

Cell Phone by Education	Not a problem at all	Moderate problem	Big problem
HS or less	51%	34%	15%
AD or some	50%	28%	21%
BS or grad	46%	35%	20%

Cell Phone by Location	Not a problem at all	Moderate problem	Big problem
Urban	71	43	25
Suburban	73	49	27
Rural	19	18	16
Total	163	110	68

Cell Phone by Location	Not a problem at all	Moderate problem	Big problem
Urban	51%	31%	18%
Suburban	49%	33%	18%
Rural	36%	34%	30%

Cell Phone by Race	Not a problem at all	Moderate problem	Big problem
All Others	133	81	44
CSET	32	31	23
Total	165	112	67

Cell Phone by Race	Not a problem at all	Moderate problem	Big problem
All Others	52%	31%	17%
CSET	37%	36%	27%

Table II.5 - Descriptive Statistics and ANOVA: Rural Safety Perception 2

Cell phone reception for emergency calls							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		348	2.53	1.199	47%	39.44	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	232	2.44	1.208	49.5%	5.422	0.020
	Female	112	2.76	1.157	41.9%		
Age	Under 25	53	2.53	1.085	42.9%	0.060	0.942
	26 to 55	127	2.57	1.219	47.4%		
	56 or older	164	2.52	1.231	48.8%		
Education	HS or less	41	2.51	1.121	44.7%	0.009	0.991
	AD or some	113	2.54	1.225	48.2%		
	BS or grad	193	2.54	1.208	47.6%		
Location	Rural	53	2.94	1.262	42.9%	3.581	0.029
	Urban	139	2.45	1.205	49.2%		
	Suburban	149	2.49	1.160	46.6%		
Race	CSET	86	2.79	1.247	44.7%	5.548	0.019
	All others	258	2.44	1.170	48.0%		

Table II.6 - Regression: Rural Safety Perception 2

Cell phone reception for emergency calls					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		
.204[a]	0.042	0.033	1.179		
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	20.004	3	6.668	4.799	.003[b]
Residual	461.326	332	1.390		
Total	481.330	335			
	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.325	0.088		26.463	0.000
Female	0.264	0.139	0.103	1.901	0.058
RURAL	0.399	0.180	0.120	2.210	0.028
CSET	0.289	0.149	0.105	1.946	0.053

3) Please rate these travel conditions on rural roads: Access to public transportation

Table II.7 - Basic statistics of responses: Rural Safety Perception 3

Public Transport by Gender	Not a problem at all	Moderate problem	Big problem
Male	113	64	56
Female	44	33	36
Total	157	97	92

Public Transport by Gender	Not a problem at all	Moderate problem	Big problem
Male	48%	27%	24%
Female	39%	29%	32%

Public Transport by Age	Not a problem at all	Moderate problem	Big problem
Under 25	29	12	11
26 to 55	58	42	29
56 or older	70	45	50
Total	157	99	90

Public Transport by Age	Not a problem at all	Moderate problem	Big problem
Under 25	56%	23%	21%
26 to 55	45%	33%	22%
56 or older	42%	27%	30%

Public Transport by Education	Not a problem at all	Moderate problem	Big problem
HS or less	24	7	9
AD or some	62	26	23
BS or grad	72	66	60
Total	158	99	92

Public Transport by Education	Not a problem at all	Moderate problem	Big problem
HS or less	60%	18%	23%
AD or some	56%	23%	21%
BS or grad	36%	33%	30%

Public Transport by Location	Not a problem at all	Moderate problem	Big problem
Urban	56	39	42
Suburban	68	48	37
Rural	31	10	12
Total	155	97	91

Public Transport by Location	Not a problem at all	Moderate problem	Big problem
Urban	41%	28%	31%
Suburban	44%	31%	24%
Rural	58%	19%	23%

Public Transport by Race	Not a problem at all	Moderate problem	Big problem
All Others	117	68	73
CSET	41	29	18
Total	158	97	91

Public Transport by Race	Not a problem at all	Moderate problem	Big problem
All Others	45%	26%	28%
CSET	47%	33%	20%

Table II.8 - Descriptive Statistics and ANOVA: Rural Safety Perception 3

Access to public transportation							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		350	2.68	1.305	49%	38.37	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	233	2.60	1.296	49.8%	2.565	0.110
	Female	113	2.84	1.327	46.7%		
Age	Under 25	52	2.50	1.213	48.5%	1.766	0.173
	26 to 55	129	2.57	1.224	47.6%		
	56 or older	165	2.81	1.379	49.1%		
Education	HS or less	40	2.35	1.312	55.8%	5.433	0.005
	AD or some	111	2.44	1.277	52.3%		
	BS or grad	198	2.87	1.294	45.1%		
Location	Rural	53	2.49	1.265	50.8%	1.553	0.213
	Urban	137	2.82	1.403	49.8%		
	Suburban	153	2.62	1.230	46.9%		
Race	CSET	88	2.47	1.250	50.6%	2.829	0.093
	All others	258	2.74	1.320	48.2%		

Table II.9 - Regression: Rural Safety Perception 3

Access to public transportation					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		
.195[a]	0.038	0.032	1.288		
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	22.478	2	11.239	6.776	.001[b]
Residual	568.912	343	1.659		
Total	591.390	345			
	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.344	0.115		20.407	0.000
Female	0.232	0.148	0.083	1.570	0.117
BSDEG	0.461	0.140	0.175	3.303	0.001

4) Please rate these travel conditions on rural roads: Road condition of state highways

Table II.10 - Basic statistics of responses: Rural Safety Perception 4

Road Condition by Gender	Not a problem at all	Moderate problem	Big problem
Male	30	74	136
Female	15	29	72
Total	45	103	208

Road Condition by Gender	Not a problem at all	Moderate problem	Big problem
Male	13%	31%	57%
Female	13%	25%	62%

Road Condition by Age	Not a problem at all	Moderate problem	Big problem
Under 25	10	17	26
26 to 55	15	41	75
56 or older	19	46	106
Total	44	104	207

Road Condition by Age	Not a problem at all	Moderate problem	Big problem
Under 25	19%	32%	49%
26 to 55	11%	31%	57%
56 or older	11%	27%	62%

Road Condition by Education	Not a problem at all	Moderate problem	Big problem
HS or less	2	15	25
AD or some	19	27	67
BS or grad	24	62	118
Total	45	104	210

Road Condition by Education	Not a problem at all	Moderate problem	Big problem
HS or less	5%	36%	60%
AD or some	17%	24%	59%
BS or grad	12%	30%	58%

Road Condition by Location	Not a problem at all	Moderate problem	Big problem
Urban	27	43	71
Suburban	13	48	95
Rural	4	11	41
Total	44	102	207

Road Condition by Location	Not a problem at all	Moderate problem	Big problem
Urban	19%	30%	50%
Suburban	8%	31%	61%
Rural	7%	20%	73%

Road Condition by Race	Not a problem at all	Moderate problem	Big problem
All Others	38	75	154
CSET	7	28	53
Total	45	103	207

Road Condition by Race	Not a problem at all	Moderate problem	Big problem
All Others	14%	28%	58%
CSET	8%	32%	60%

Table II.11 - Descriptive Statistics and ANOVA: Rural Safety Perception 4

Road condition of state highways							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		360	3.77	1.154	31%	61.91	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	240	3.75	1.158	30.9%	0.088	0.088
	Female	116	3.79	1.161	30.6%		
Age	Under 25	53	3.43	1.065	31.0%	2.652	0.072
	26 to 55	131	3.82	1.115	29.2%		
	56 or older	171	3.84	1.202	31.3%		
Education	HS or less	42	3.95	0.987	25.0%	0.687	0.504
	AD or some	113	3.71	1.222	32.9%		
	BS or grad	204	3.76	1.151	30.6%		
Location	Rural	56	4.04	1.095	27.1%	5.668	0.004
	Urban	141	3.52	1.257	35.7%		
	Suburban	156	3.89	1.038	26.7%		
Race	CSET	88	3.87	1.091	28.2%	1.089	0.297
	All others	267	3.73	1.178	31.6%		

Table II.12 - Regression: Rural Safety Perception 4

Road condition of state highways			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.222[a]	0.049	0.038	1.133

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	22.842	4	5.711	4.451	.002[b]
Residual	441.358	344	1.283		
Total	464.201	348			

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	3.570	0.100		35.754	0.000
Age25	-0.440	0.177	-0.136	-2.489	0.013
HSDEG	0.320	0.194	0.090	1.650	0.100
SUBURB	0.328	0.133	0.141	2.476	0.014
RURAL	0.510	0.180	0.161	2.826	0.005

5) Please rate these travel conditions on rural roads: Hidden, missing or defaced traffic signs

Table II.13 - Basic statistics of responses: Rural Safety Perception 5

Traffic Signs by Gender	Not a problem at all	Moderate problem	Big problem
Male	71	94	75
Female	32	44	41
Total	103	138	116

Traffic Signs by Gender	Not a problem at all	Moderate problem	Big problem
Male	30%	39%	31%
Female	27%	38%	35%

Traffic Signs by Age	Not a problem at all	Moderate problem	Big problem
Under 25	26	17	10
26 to 55	41	56	35
56 or older	36	66	69
Total	103	139	114

Traffic Signs by Age	Not a problem at all	Moderate problem	Big problem
Under 25	49%	32%	19%
26 to 55	31%	42%	27%
56 or older	21%	39%	40%

Traffic Signs by Education	Not a problem at all	Moderate problem	Big problem
HS or less	12	14	16
AD or some	37	41	35
BS or grad	54	86	65
Total	103	141	116

Traffic Signs by Education	Not a problem at all	Moderate problem	Big problem
HS or less	29%	33%	38%
AD or some	33%	36%	31%
BS or grad	26%	42%	32%

Traffic Signs by Location	Not a problem at all	Moderate problem	Big problem
Urban	37	61	44
Suburban	46	56	54
Rural	18	21	17
Total	101	138	115

Traffic Signs by Location	Not a problem at all	Moderate problem	Big problem
Urban	26%	43%	31%
Suburban	29%	36%	35%
Rural	32%	38%	30%

Traffic Signs by Race	Not a problem at all	Moderate problem	Big problem
All Others	83	100	85
CSET	20	39	29
Total	103	139	114

Traffic Signs by Race	Not a problem at all	Moderate problem	Big problem
All Others	31%	37%	32%
CSET	23%	44%	33%

Table II.14 - Descriptive Statistics and ANOVA: Rural Safety Perception 5

Hidden, missing or defaced traffic signs							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		361	3.07	1.206	39%	48.37	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	240	3.06	1.209	39.5%	0.068	0.794
	Female	117	3.09	1.225	39.6%		
Age	Under 25	53	2.60	1.025	39.4%	7.079	0.001
	26 to 55	132	2.97	1.223	41.2%		
	56 or older	171	3.27	1.208	36.9%		
Education	HS or less	42	3.21	1.200	37.4%	0.619	0.539
	AD or some	113	2.98	1.225	41.1%		
	BS or grad	205	3.09	1.201	38.9%		
Location	Rural	56	2.96	1.250	42.2%	0.261	0.770
	Urban	142	3.10	1.251	40.4%		
	Suburban	156	3.08	1.164	37.8%		
Race	CSET	88	3.20	1.205	37.7%	1.708	0.192
	All others	268	3.01	1.204	40.0%		

Table II.15 - Regression: Rural Safety Perception 5

Hidden, missing or defaced traffic signs			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.223[a]	0.050	0.041	1.184

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	25.573	3	8.524	6.080	.000[b]
Residual	489.294	349	1.402		
Total	514.867	352			

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.861	0.115		24.769	0.000
Age25	-0.364	0.193	-0.108	-1.891	0.059
Age56	0.359	0.141	0.148	2.546	0.011
CSET	0.316	0.149	0.113	2.117	0.035

6) Please rate these travel conditions on rural roads: Faded or worn out lane markings

Table II.16 - Basic statistics of responses: Rural Safety Perception 6

Lane Markings by Gender	Not a problem at all	Moderate problem	Big problem
Male	42	78	122
Female	17	42	56
Total	59	120	178

Lane Markings by Gender	Not a problem at all	Moderate problem	Big problem
Male	17%	32%	50%
Female	15%	37%	49%

Lane Markings by Age	Not a problem at all	Moderate problem	Big problem
Under 25	12	19	22
26 to 55	24	41	68
56 or older	23	61	86
Total	59	121	176

Lane Markings by Age	Not a problem at all	Moderate problem	Big problem
Under 25	23%	36%	42%
26 to 55	18%	31%	51%
56 or older	14%	36%	51%

Lane Markings by Education	Not a problem at all	Moderate problem	Big problem
HS or less	7	13	22
AD or some	13	40	60
BS or grad	39	70	96
Total	59	123	178

Lane Markings by Education	Not a problem at all	Moderate problem	Big problem
HS or less	17%	31%	52%
AD or some	12%	35%	53%
BS or grad	19%	34%	47%

Lane Markings by Location	Not a problem at all	Moderate problem	Big problem
Urban	29	44	70
Suburban	23	54	79
Rural	7	21	27
Total	59	119	176

Lane Markings by Location	Not a problem at all	Moderate problem	Big problem
Urban	20%	31%	49%
Suburban	15%	35%	51%
Rural	13%	38%	49%

Lane Markings by Race	Not a problem at all	Moderate problem	Big problem
All Others	49	92	129
CSET	10	28	48
Total	59	120	177

Lane Markings by Race	Not a problem at all	Moderate problem	Big problem
All Others	18%	34%	48%
CSET	12%	33%	56%

Table II.17 - Descriptive Statistics and ANOVA: Rural Safety Perception 6

Faded or worn out lane markings							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		361	3.5	1.16	33%	57.41	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	242	3.53	1.171	33.2%	0.202	0.653
	Female	115	3.47	1.157	33.3%		
Age	Under 25	53	3.26	1.179	36.2%	1.411	0.245
	26 to 55	133	3.52	1.204	34.2%		
	56 or older	170	3.57	1.130	31.7%		
Education	HS or less	42	3.60	1.106	30.7%	0.781	0.459
	AD or some	113	3.59	1.147	31.9%		
	BS or grad	205	3.44	1.181	34.3%		
Location	Rural	55	3.51	1.169	33.3%	0.087	0.916
	Urban	143	3.48	1.244	35.7%		
	Suburban	156	3.53	1.098	31.1%		
Race	CSET	86	3.69	1.109	30.1%	2.738	0.099
	All others	270	3.45	1.177	34.1%		

Table II.18 - Regression: Rural Safety Perception 6

Faded or worn out lane markings			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.156[a]	0.024	0.016	1.159

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	11.696	3	3.899	2.904	.035[b]
Residual	468.548	349	1.343		
Total	480.244	352			

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	3.638	0.119		30.604	0.000
Age25	-0.422	0.186	-0.129	-2.271	0.024
BSDEG	-0.222	0.136	-0.094	-1.633	0.103
CSET	0.229	0.146	0.084	1.571	0.117

7) Please rate these travel conditions on rural roads: No traffic lights at rural intersections

Table II.19 - Basic statistics of responses: Rural Safety Perception 7

Traffic Light by Gender	Not a problem at all	Moderate problem	Big problem
Male	112	65	62
Female	47	41	27
Total	159	106	89

Traffic Light by Gender	Not a problem at all	Moderate problem	Big problem
Male	47%	27%	26%
Female	41%	36%	23%

Traffic Light by Age	Not a problem at all	Moderate problem	Big problem
Under 25	30	18	5
26 to 55	61	42	28
56 or older	68	44	57
Total	159	104	90

Traffic Light by Age	Not a problem at all	Moderate problem	Big problem
Under 25	57%	34%	9%
26 to 55	47%	32%	21%
56 or older	40%	26%	34%

Traffic Light by Education	Not a problem at all	Moderate problem	Big problem
HS or less	16	17	9
AD or some	56	31	25
BS or grad	89	58	56
Total	161	106	90

Traffic Light by Education	Not a problem at all	Moderate problem	Big problem
HS or less	38%	40%	21%
AD or some	50%	28%	22%
BS or grad	44%	29%	28%

Traffic Light by Location	Not a problem at all	Moderate problem	Big problem
Urban	55	45	40
Suburban	69	44	42
Rural	34	15	7
Total	158	104	89

Traffic Light by Location	Not a problem at all	Moderate problem	Big problem
Urban	39%	32%	29%
Suburban	45%	28%	27%
Rural	61%	27%	13%

Traffic Light by Race	Not a problem at all	Moderate problem	Big problem
All Others	122	82	61
CSET	38	22	28
Total	160	104	89

Traffic Light by Race	Not a problem at all	Moderate problem	Big problem
All Others	46%	31%	23%
CSET	43%	25%	32%

Table II.20 - Descriptive Statistics and ANOVA: Rural Safety Perception 7

No traffic lights at rural intersections							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		358	2.72	1.251	46%	41.11	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	239	2.69	1.272	47.3%	0.421	0.517
	Female	115	2.78	1.212	43.6%		
Age	Under 25	53	2.32	0.976	42.1%	4.692	0.010
	26 to 55	131	2.65	1.170	44.2%		
	56 or older	169	2.90	1.370	47.2%		
Education	HS or less	42	2.67	1.262	47.3%	0.578	0.562
	AD or some	112	2.63	1.216	46.2%		
	BS or grad	203	2.78	1.272	45.8%		
Location	Rural	56	2.34	1.133	48.4%	3.058	0.048
	Urban	140	2.81	1.280	45.6%		
	Suburban	155	2.77	1.258	45.4%		
Race	CSET	88	2.88	1.320	45.8%	2.013	0.157
	All others	265	2.66	1.227	46.1%		

Table II.21 - Regression: Rural Safety Perception 7

No traffic lights at rural intersections			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.234[a]	0.055	0.044	1.236

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	30.136	4	7.534	4.930	.001[b]
Residual	519.591	340	1.528		
Total	549.728	344			

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.589	0.124		20.921	0.000
Age25	-0.293	0.203	-0.083	-1.440	0.151
Age56	0.344	0.149	0.136	2.310	0.021
RURAL	-0.466	0.185	-0.133	-2.521	0.012
CSET	0.323	0.157	0.111	2.059	0.040

8) Please rate these travel conditions on rural roads: Lighting at night

Table II.22 - Basic statistics of responses: Rural Safety Perception 8

Night Light by Gender	Not a problem at all	Moderate problem	Big problem
Male	77	75	88
Female	26	39	51
Total	103	114	139

Night Light by Gender	Not a problem at all	Moderate problem	Big problem
Male	32%	31%	37%
Female	22%	34%	44%

Night Light by Age	Not a problem at all	Moderate problem	Big problem
Under 25	21	12	20
26 to 55	30	53	50
56 or older	54	45	70
Total	105	110	140

Night Light by Age	Not a problem at all	Moderate problem	Big problem
Under 25	40%	23%	38%
26 to 55	23%	40%	38%
56 or older	32%	27%	41%

Night Light by Education	Not a problem at all	Moderate problem	Big problem
HS or less	11	12	19
AD or some	36	35	43
BS or grad	58	67	78
Total	105	114	140

Night Light by Education	Not a problem at all	Moderate problem	Big problem
HS or less	26%	29%	45%
AD or some	32%	31%	38%
BS or grad	29%	33%	38%

Night Light by Location	Not a problem at all	Moderate problem	Big problem
Urban	38	48	54
Suburban	43	47	67
Rural	22	18	16
Total	103	113	137

Night Light by Location	Not a problem at all	Moderate problem	Big problem
Urban	27%	34%	39%
Suburban	27%	30%	43%
Rural	39%	32%	29%

Night Light by Race	Not a problem at all	Moderate problem	Big problem
All Others	82	93	92
CSET	23	19	46
Total	105	112	138

Night Light by Race	Not a problem at all	Moderate problem	Big problem
All Others	31%	35%	34%
CSET	26%	22%	52%

Table II.23 - Descriptive Statistics and ANOVA: Rural Safety Perception 8

Lighting at night							
Full Sample		**N**	**Mean**	**Std Dev**	**COV**	**t**	**sig**
		360	3.16	1.288	41%	46.62	0.000
		N	**Mean**	**Std Dev**	**COV**	**F**	**Sig.**
Gender	Male	240	3.06	1.296	42.4%	5.750	0.017
	Female	116	3.41	1.244	36.5%		
Age	Under 25	63	3.06	1.307	42.7%	0.243	0.784
	26 to 55	133	3.20	1.223	38.2%		
	56 or older	169	3.17	1.354	42.7%		
Education	HS or less	42	3.45	1.273	36.9%	1.216	0.298
	AD or some	114	3.15	1.319	41.9%		
	BS or grad	203	3.11	1.275	41.0%		
Location	Rural	56	2.96	1.206	40.7%	0.774	0.462
	Urban	140	3.20	1.337	41.8%		
	Suburban	157	3.20	1.283	40.1%		
Race	CSET	88	3.45	1.312	38.0%	6.264	0.013
	All others	267	3.06	1.273	41.6%		

Table II.24 - Regression: Rural Safety Perception 8

Lighting at night			
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
.195[a]	0.038	0.030	1.276

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	22.007	3	7.336	4.507	.004[b]
Residual	558.298	343	1.628		
Total	580.305	346			

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	3.016	0.094		32.163	0.000
Female	0.327	0.148	0.119	2.217	0.027
RURAL	-0.306	0.190	-0.086	-1.615	0.107
CSET	0.370	0.159	0.124	2.325	0.021